Growth in Arithmetic

DISCOVERY EDITION

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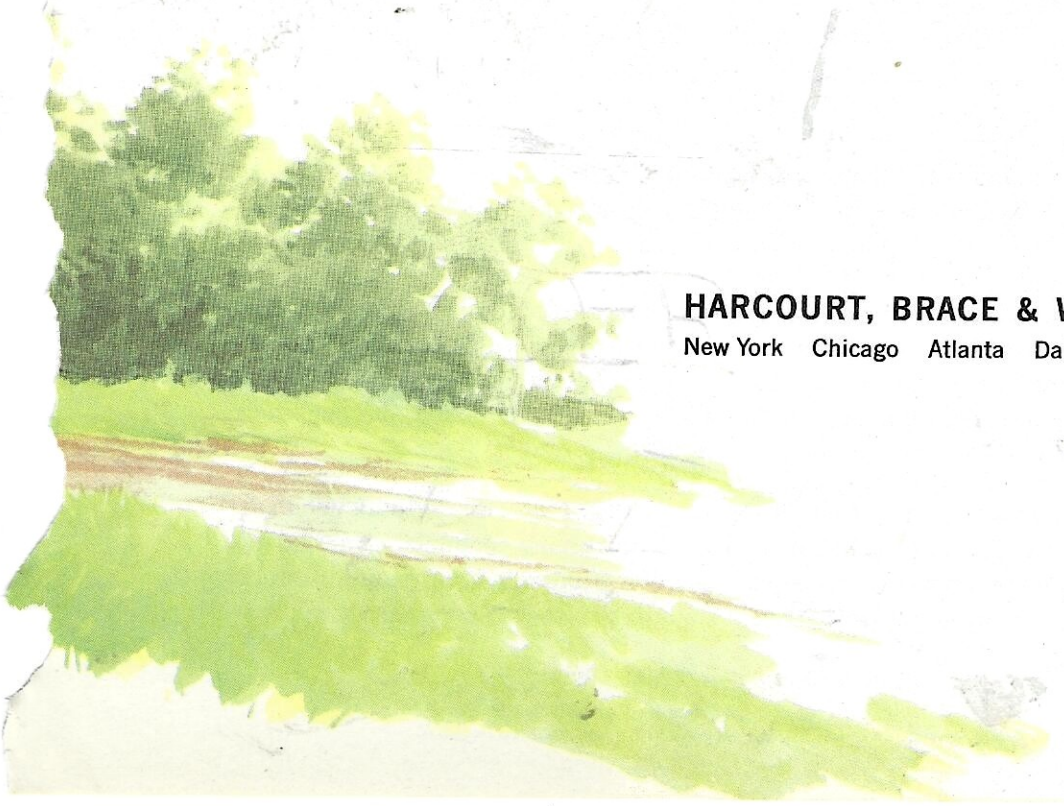
DISCOVERY EDITION

JOHN R. CLARK
HAROLD E. MOSER
CAROLINE H. CLARK
CHARLOTTE W. JUNGE



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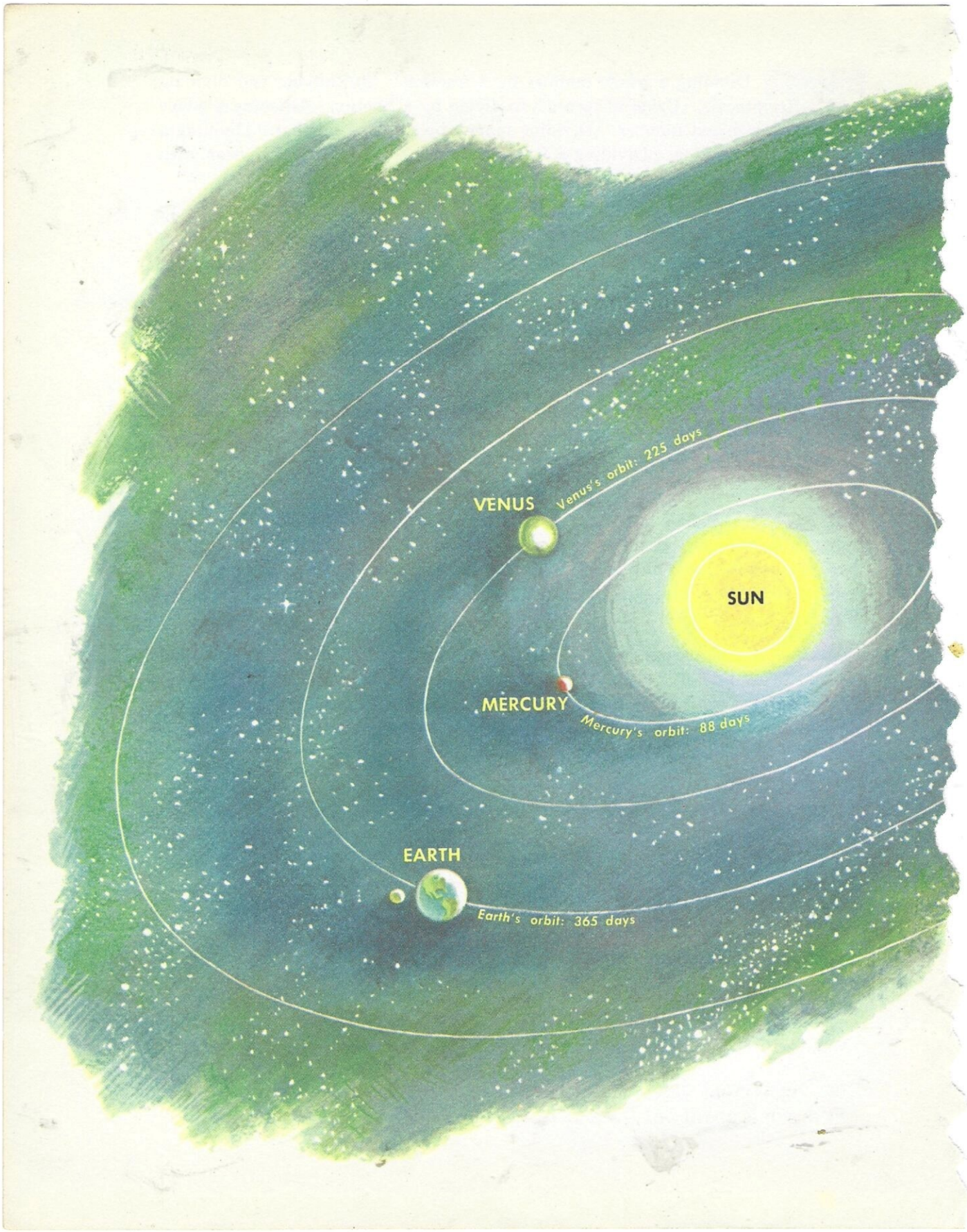
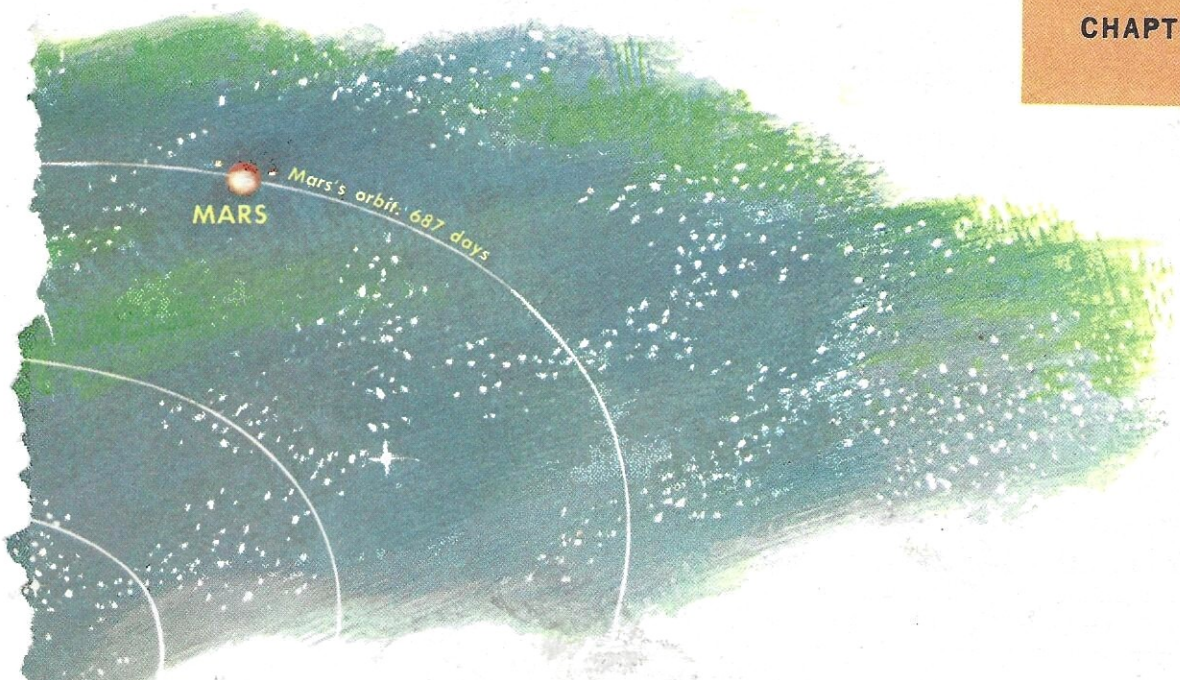

VENUS
Venus's orbit: 225 days
SUN
MERCURY
Mercury's orbit: 88 days
EARTH
Earth's orbit: 365 days

CHAPTER 1



Our planet neighbors

We need numbers as large as millions when we talk about distances in space.

- The planet Venus is our nearest neighbor. When Venus is closest to the earth, it is about 26,000,000 miles distant.
- The average distance from Venus to the sun is about 67,200,000 miles.
- Mercury is the planet closest to the sun. The average distance from Mercury to the sun is estimated to be 36,000,000 miles.
- The average distance from Earth to the sun is about 92,900,000 miles.
- The average distance from Mars to the sun is about 141,000,000 miles.

1. One meaning of the word *year* is the length of time it takes a planet to make one complete revolution around the sun.

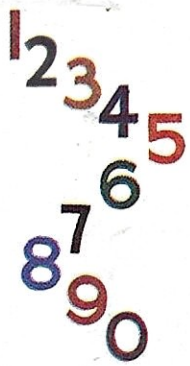
How many days are there in a year on Earth? on Mercury? on Venus?

2. The planet Mars completes its orbit of the sun in 687 days.

How many days longer does it take Mars to complete an orbit than Earth? than Venus? than Mercury?

Think twice!

Suppose that a boy on Earth is 8 years old. About how old would he be in Mercury-length years? About how old would he be in Mars-length years?



Symbols for numbers

1. Numbers are ideas. We cannot see or write numbers. They exist only in our minds. We represent numbers by symbols, called ***numerals***.

Symbols to represent the number of fingers on one hand are:

five V 5 4 + 1 3 + 2 /////

Represent the number of days in a week in five ways.

2. We use the Hindu-Arabic numerals shown in the table below. Also shown in the table are some of the numerals used by the Romans.

Write the Hindu-Arabic and the Roman numerals for the numbers from eleven through twenty.

HINDU–ARABIC	1	2	3	4	5	6	7	8	9	10
ROMAN	I	II	III	IV	V	VI	VII	VIII	IX	X

3. The numeral 43 means 4 tens and 3 ones. The 3 is in ones place and the 4 is in ? place.

4. What number is represented by the numeral 34? 98? 102?

5. Which of these is a 1-figure, or a 1-place, or 1-digit numeral? a 3-digit numeral? a 4-digit?

3
54
104
1029

6. What is the smallest number that can be represented by a 3-digit numeral? the largest?

7. Write the numeral which has a 4 in thousands place, a 3 in hundreds place, a 0 in tens place, and a 5 in ones place.

Numerals, or groups of numerals, such as $7 + 5$, 6×2, $\frac{1}{2}$ of 24, $15 - 3$, are called ***number expressions***.

8. What number is represented by each of the number expressions in the preceding paragraph?

Number expressions which represent the same number are called ***equivalent number expressions***.

9. Write six equivalent number expressions for the number of minutes in an hour.

We cannot add, subtract, multiply, or divide *numerals*. We add, subtract, multiply, or divide the *numbers* represented by numerals.

Most persons find it inconvenient to distinguish between number and numeral at all times. This text usually uses the word *number* to refer either to number or numeral.

Adding on a machine

In the picture Dan has just finished adding on a special adding machine. The answer to his addition is 46,550. Can you find it on the machine? The sum appears in the little windows at the top of the keyboard.

1. Each window stands for a position in the numeral system. Which numeral is in ones place? Name the other places.

2. This diagram → shows the keys to press to register the numeral 46,550. Why is there no key for 0?

0	4	6	5	5	0
9	9	9	9	9	9
8	8	8	8	8	8
7	7	7	7	7	7
6	6	6	(6)	6	6
5	5	5	5	(5)	(5)
4	4	(4)	4	4	4
3	3	3	3	3	3
2	2	2	2	2	2
1	1	1	1	1	1

3. Tell which keys you would press to add these amounts: 596; 8,000; 305; 10,500.

4. Is the value of any 5 on the keyboard of the adding machine 10 times as much as the value of any 5 to the right of it?

- 500 is ? times 50.
- 5,000 is 10 times ?.
- ? is 10 times 50,000.

5. In his next addition, Dan added three numbers. Box A shows that the first number was 1975.

A

0	0	1	9	7	5
9	9	9	(9)	9	9
8	8	8	8	8	8
7	7	7	7	(7)	7
6	6	6	6	6	6
5	5	5	5	5	(5)
4	4	4	4	4	4
3	3	3	3	3	3
2	2	2	2	2	2
1	1	(1)	1	1	1

B

0	0	2	8	7	5
9	9	9	(9)	9	9
8	8	8	8	8	8
7	7	7	7	7	7
6	6	6	6	6	6
5	5	5	5	5	5
4	4	4	4	4	4
3	3	3	3	3	3
2	2	2	2	2	2
1	1	1	1	1	1

C

0	0	4	8	8	0
9	9	9	9	9	9
8	8	8	8	8	8
7	7	7	7	7	7
6	6	6	6	6	6
5	5	5	5	5	(5)
4	4	4	4	4	4
3	3	3	3	3	3
2	2	(2)	2	2	2
1	1	1	1	1	1

- Box B shows that the second number was ?.
- Box C shows that the third number was ?. What is the total?
- Explain the 2,875 that you see in the place for the total in Box B.

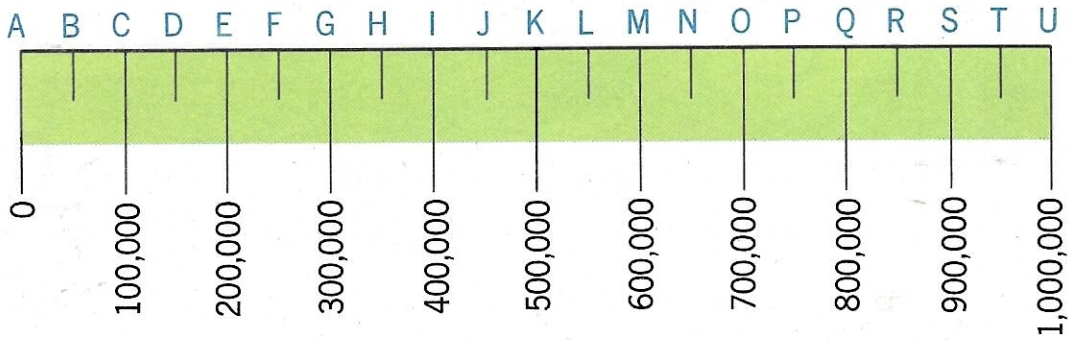
6. What is the largest total that Dan's machine can register?

7. Is any 6 on the machine worth $\frac{1}{10}$ as much as the 6 to the left of it?

- 60 is $\frac{1}{10}$ as much as ?.
- ? is $\frac{1}{10}$ as much as 6,000.
- 6,000 is $\frac{1}{10}$ as much as ?.

8. How would you use the adding machine to count by 10's? by 100's?

How large is a million?



— Use the scale above to answer these questions. See how many ways of thinking about a million you can learn from it.

1. Notice that the numbers on the scale go from zero to one million.

- Point B is at the 50,000 mark.
- Point C is at the 100,000 mark.
- Point D is at the ? mark.

2. What letter is at the 250,000 mark? at the 750,000 mark? at the 950,000 mark?

3. Between what two letters on the scale could a mark for 25,000 be placed? Explain.

4. Between what two letters could a mark for 75,000 be placed? for 675,000? for 925,000?

5. How many 100,000's make a million?

6. How does the scale show that there are 1,000 thousands in a million?

7. Count to a million by 50,000's.

8. Some large baseball stadiums hold 50,000 persons. How many 50,000's are there in a million?

9. Would you say that 50,000 is $\frac{1}{10}$, or $\frac{1}{20}$, of a million?

10. How many 500,000's are there in a million?

11. A $500,000 school costs what part of a million dollars?

12. How many 250,000's are there in a million?

13. How many thousand people are there in a city with a population of a quarter-million?

14. Begin with 250,000 and count to a million by quarter-millions.

15. The population of the State of Utah is about three quarters of a million. How many thousand people is this?

16. How many dollars must be added to $850,000 to make a million?

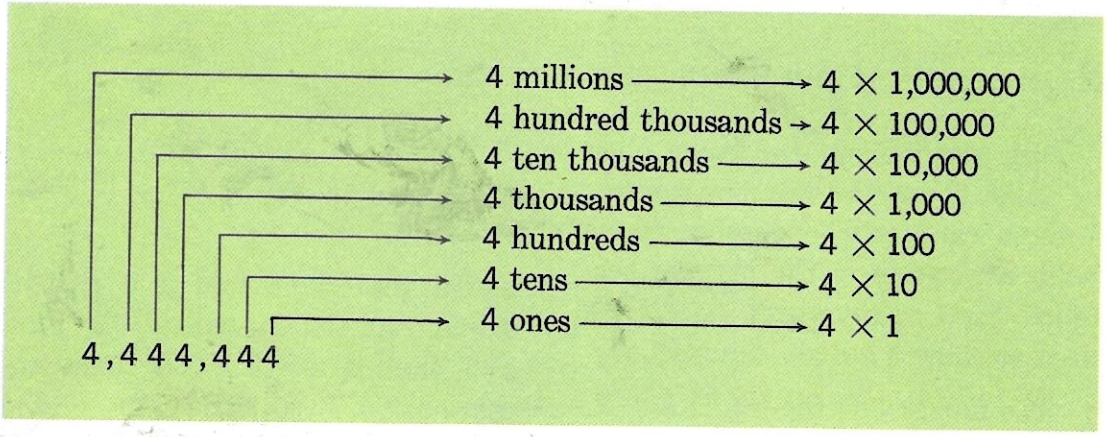
Our system of number notation

1. We use 10 *figures* or *digits:* 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 to represent *numbers*. With these we can express any number.

In the number 234, the 4 is in ones place and stands for 4×1. The 3 is in tens place and stands for $\underline{?} \times 10$. The 2 is in hundreds place and stands for, or has a value of, $\underline{?} \times 100$.

200
30
4
234

2. How does this chart teach that the position of a digit in a number shows its value?


4 millions → 4 × 1,000,000
4 hundred thousands → 4 × 100,000
4 ten thousands → 4 × 10,000
4 thousands → 4 × 1,000
4 hundreds → 4 × 100
4 tens → 4 × 10
4 ones → 4 × 1
4,444,444

3. The chart in Ex. 2 shows that:

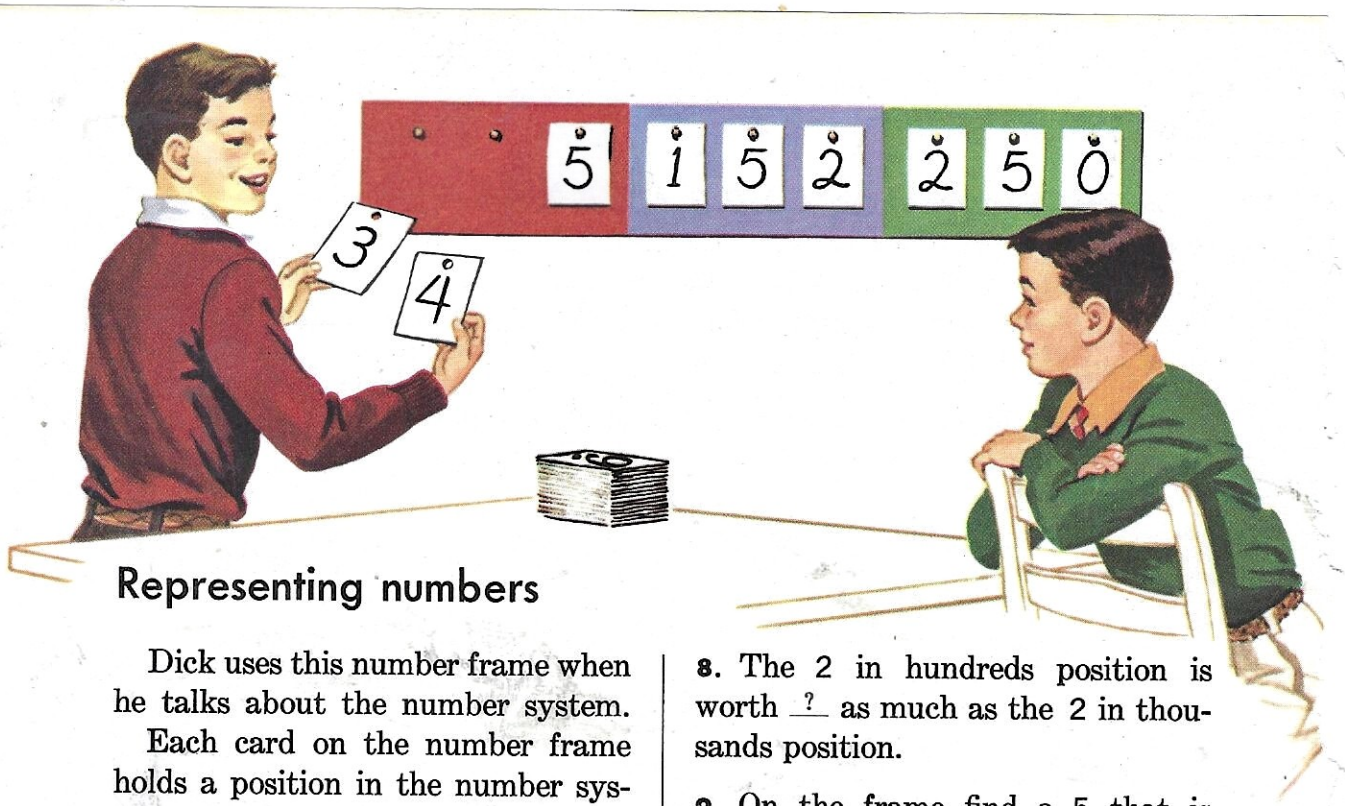
- The value of the 4 in tens place is 10 times the value of the 4 in $\underline{?}$ place.
- The value of the 4 in hundreds place is $\underline{?}$ times the value of the 4 in tens place.
- The value of any 4 in the number is 10 times the value of the 4 to the $\underline{?}$ of it.
- The value of the 4 in ones place is $\frac{1}{10}$ the value of the 4 in $\underline{?}$ place.
- The value of any 4 in the number is $\frac{1}{10}$ the value of the 4 to the $\underline{?}$ of it.

4. Here is a study of the number 2,467,035. In 2,467,035:

2 means $2 \times 1{,}000{,}000$ →	2,000,000
4 means $4 \times 100{,}000$ →	400,000
6 means $6 \times 10{,}000$ →	60,000
7 means $7 \times 1{,}000$ →	7,000
0 means 0×100 →	0
3 means 3×10 →	30
5 means 5×1 →	5
	2,467,035

Write a similar study for the number 48,206; 156,084.

5. What is the meaning of each figure in the number 5,678,000?



Representing numbers

Dick uses this number frame when he talks about the number system.

Each card on the number frame holds a position in the number system. How many cards does Dick need to show a 4-digit number?

1. The number on the frame is a ? digit number.

2. How does the number frame use color to show where the commas should be placed?

3. The positions colored red show how many ?.

4. The positions colored blue show how many ?.

5. The positions colored green show how many ?, ?, and ones.

6. Why do you think that Dick made the extra cards?

7. The 2 in thousands position on the frame is worth ? times as much as the 2 in hundreds position.

8. The 2 in hundreds position is worth ? as much as the 2 in thousands position.

9. On the frame find a 5 that is worth 100 times another 5. Find a 5 that is worth 1,000 times another 5.

— Tell how you would change the number on the frame to make a new number the value of which will be:

10. Larger by 1 thousand

11. Larger by 10 thousand

12. Larger by 1 million

13. Smaller by 100 thousand

14. Smaller by 22 hundred

15. Larger by 50 thousand

16. Smaller by $\frac{1}{2}$ a hundred

17. Larger by $\frac{1}{2}$ a thousand

18. Larger by $\frac{1}{2}$ a million

Written practice

1. Draw a chart on your paper as shown below. On the top line write the letter A and the digits shown. Then letter the lines following from B to K.

A	2	0	0	8	1	4	0
B							
C							
D							

- Rearrange the digits in Row A to express the smallest number that you can. (Write the rearranged digits in Row B of your chart.)
- Rearrange the digits to express the largest number you can. (Use Row C.)
- Write a number that is greater than A by 90 thousand; by 2 thousand. (Use Rows D and E.)
- What number is less than A by 50? by 100 thousand? (Use Rows F and G.)
- Write a number that is smaller than A by 1,000 thousand; larger than A by a quarter of a million. (Use Rows H and I.)
- What number is half as large as A? (Use Row J.)
- If you take 11 hundred from A, what number is left? (Use Row K.)

— Write a number that is 1 less than each of the following.

	a	*b*	*c*
2.	100,000	1,000,000	10,000,000
3.	299,010	508,000	9,110,000

— Write a number 1 more than:

4.	9,999	56,789	99,999
5.	90,999	10,099	15 hundred

— Write a number that is $\frac{1}{2}$ of:

6.	1,000,000	10,000	1,000
7.	410,000	100,000	25 hundred

— Write in figures.

8. Five hundred thousand, eighty
9. Six million, five hundred
10. Ten million, six thousand
11. Forty thousand, nine
12. One million, three hundred eight thousand, one hundred two
13. Twelve and one-half hundreds

— The number in Column *a* is how many times the number in Column *b*?

	a	*b*
14.	3,000	300
15.	500,000	50,000
16.	900,000	9,000
17.	1,000,000	100,000
18.	1,000,000	1,000

Multiplying and dividing by 10, by 100, by 1000

This chart will help you to learn a short cut for multiplying by 10, by 100, and by 1000 by changing the positions of the digits.

Look at the top 7 on the chart. Its value is 7 ones. The number just under it (70) has a value of 10 times 7. The number two lines under it (700) has a value of 100 times as much as the 7.

					7
				7	0
			7	0	0
		7	0	0	0
	7	0	0	0	0
7	0	0	0	0	0

1. The number that is three lines below the first 7 on the chart has a value of ? × 7.

— Tell the products.

2.
10×7
10×70
10×700
10×7000
$10 \times 70{,}000$

100×7
100×70
100×700
100×7000

3.
1000×7
1000×70
1000×700

A quick way to multiply a whole number by 10 is to attach a zero to the right of it. Attaching a zero to a number is called ***annexing a zero.***

Annexing a zero to a whole number multiplies the number by 10.

Annexing two zeros multiplies the number by 100.

Annexing three zeros multiplies the number by 1000.

4. The chart will help you to learn a short cut for dividing by 10, by 100, and by 1000 when numbers end in zeros.

- Look at the chart. The number just above 7000 is 7000 ÷ 10, or ?.
- The number two lines above 7000 is 7000 ÷ 100, or ?.
- The number three lines above 7000 is 7000 ÷ 1000, or ?.

— Tell the quotients.

5.
$700{,}000 \div 10$
$70{,}000 \div 10$
$7000 \div 10$
$700 \div 10$
$70 \div 10$

$700{,}000 \div 100$
$70{,}000 \div 100$
$7000 \div 100$
$700 \div 100$

6.
$700{,}000 \div 1000$
$70{,}000 \div 1000$
$7000 \div 1000$

7. Make rules for dividing a whole number (ending in zero or zeros) by 10, by 100, and by 1000.

Billions

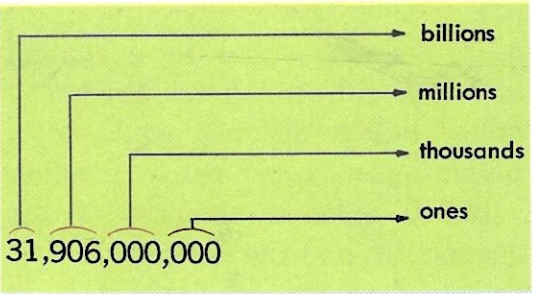
The table below shows the value of different kinds of money in circulation in the United States in one day in a recent year.

Value of Money in Circulation in the United States in a Recent Year

KIND OF MONEY	VALUE
All coins	$2,182,000,000
1-dollar bills	1,494,000,000
2-dollar bills	83,000,000
5-dollar bills	2,186,000,000
10-dollar bills	6,624,000,000
20-dollar bills	10,000,000,000
Larger bills	9,337,000,000
Total	$31,906,000,000

The total amount of money in circulation is read: 31 *billion*, 906 *million* dollars.

The diagram below will help you understand the numbers in the table.



1. Read the value of all the coins in circulation. How many types of coins can you name?

2. Read the value of each type of paper money in use.

3. What is meant by "larger" bills? Read the amount of money in larger bills.

4. One billion (1,000,000,000) is a ? digit number. It is written with a 1 and ? zeros.

5. How many 1-dollar bills does it take to have a value of $\frac{1}{2}$ billion dollars? to have a value of $\frac{1}{4}$ billion dollars?

6. The paper money in circulation is worth how many billions of dollars? how many millions of dollars?

7. Write in figures.
   - 9 billion
   - 500 billion
   - 2 billion
   - 20 billion, 100 million
   - 7 billion, 125 million, 500 thousand

Think twice!

8. Are there more 1-dollar bills or 10-dollar bills in circulation?

9. Are there more 10-dollar bills or 20-dollar bills in circulation?

10. In a recent year the amount of taxes collected by the U.S. government amounted to $79,978,476,000. The money in circulation that year was $31,906,000,000. How can people pay more taxes in one year than there is money in circulation?

How large is a billion?

$10 \times 10 = 100$
$10 \times 10 \times 10 = 1{,}000$
$10 \times 10 \times 10 \times 10 = 10{,}000$
$10 \times 10 \times 10 \times 10 \times 10 = 100{,}000$
$10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1{,}000{,}000$
$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10{,}000{,}000$
$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 100{,}000{,}000$
$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1{,}000{,}000{,}000$

1. Study the chart above. See how many things about our number system you can learn from it.

2. Sue said that 1,000 million is a billion. Multiply a million by 1,000 to check her statement.

- Sue gave this illustration of the meaning of a billion. If each of 1,000 persons has \$1,000,000, then together they have \$? .
- Give another illustration of this meaning of a billion.

3. How many cities with a population of a million persons would it take to make a billion persons?

4. Mary figured that a million is $100 \times 100 \times 100$. Check her idea.

5. The population of our country is about 180 million. How much money would there be in our country if each person had \$1? \$10?

6. Are there more than a billion persons living in the world today? Maybe you can find the answer to this question in your library.

7. Bill said that a billion is $1{,}000 \times 1{,}000 \times 1{,}000$. He gave this example.

- There are 1,000 nails in a bag.
- There are 1,000 of these bags of nails packed in a carton.
- There are 1,000 cartons of the nails in a freight car.
- In the whole shipment there are $1{,}000 \times 1{,}000 \times 1{,}000$ nails, or a billion nails.

Give another illustration of this meaning of a billion.

8. A distance equal to a million inches would stretch for almost 16 miles, but a distance equal to a billion inches would reach ? miles.

16,000 miles is about $\frac{2}{3}$ of the distance around the earth.

9. If a planet travels about 1 million miles each 24 hours in its orbit around the sun, about how many days will it take the planet to travel 1 billion miles? about how many years?

Rounding numbers

Steve estimated the sum of these three amounts by thinking, "$10 + $30 + $35 = $75."

$10.23
29.65
35.17

He *rounded* each amount to the *nearest dollar*.

When you *round* to the nearest dollar, you think of any amount of money from $9.50 to $10.49 as $10.

— Round to the nearest dollar.

	a	*b*	*c*
1.	$19.76	$9.95	$99.85
2.	$39.80	$10.47	$100.21
3.	$18.40	$19.80	$1,000.18

4. How does rounding to the nearest dollar help you round *to the nearest hundred?*

Round to the nearest hundred.

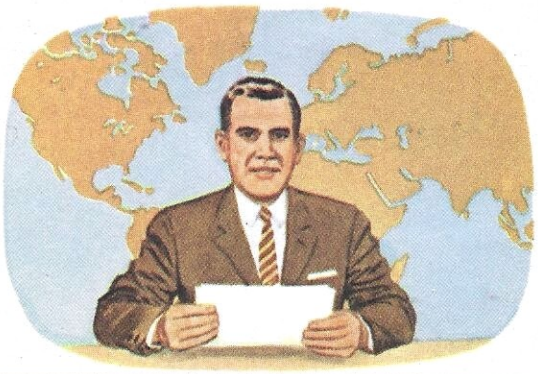
279 328 450 986

5. After a 2,987-mile trip, Bill said: "We drove about 3 thousand miles."

Bill rounded to the *nearest thousand*. When rounded to the nearest thousand, any number from 2,500 to 3,499 is thought of as 3,000.

— Round to the nearest thousand; to the nearest hundred.

	a	*b*	*c*
6.	2,995	4,568	7,032
7.	3,045	47,659	100,317
8.	8,320	40,652	909,009



A television commentator said that the population of the United States is 179 million. He had rounded 179,323,175 to the *nearest million*.

— Round to the nearest million.

	a	*b*
9.	149,975,621	987,659
10.	150,270,512	1,012,110
11.	849,980,256	500,400,000
12.	850,276,194	499,850,000

13. One newspaper claimed that a new housing project will cost about $2\frac{1}{2}$ million dollars.

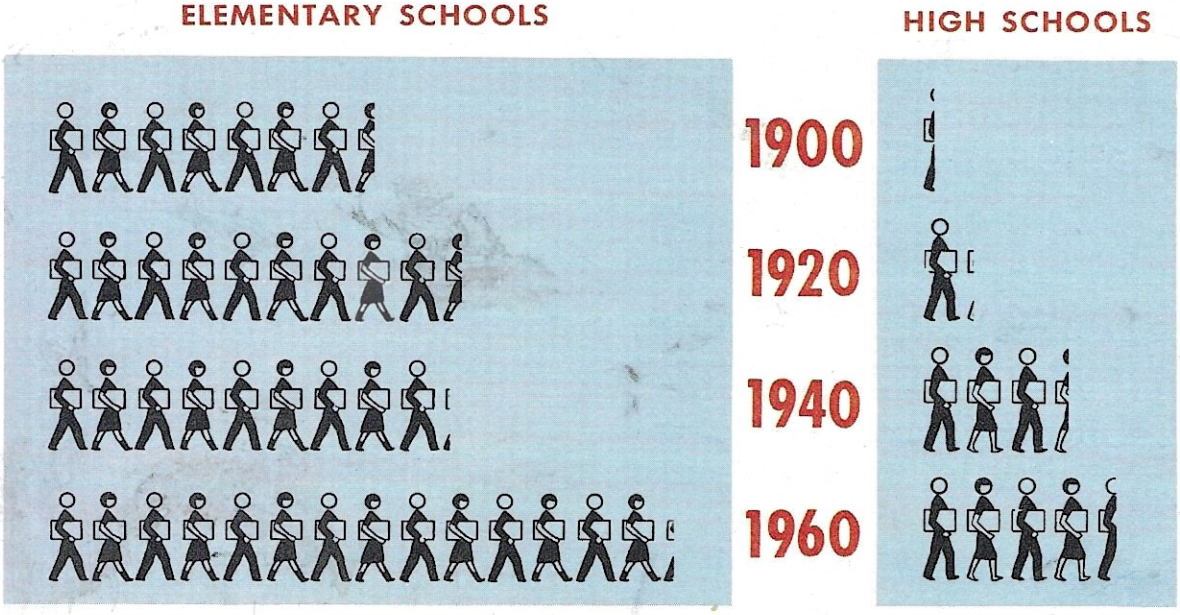
Another newspaper said it will cost about $2,500,000.

Are the amounts given in the two statements equal? Explain.

— Write each of the following amounts in another way.

	a	*b*
14.	A quarter million	$3\frac{1}{2}$ million
15.	$2\frac{1}{4}$ million	$\frac{3}{4}$ million
16.	250,000,000	$\frac{1}{2}$ billion
17.	2,500,000	$\frac{1}{4}$ billion

PUBLIC-SCHOOL ENROLLMENT



Each symbol = 2 million public-school pupils enrolled

A pictogram

A *pictogram* is a way of showing number facts in a picture.

1. In the pictogram above, each symbol stands for ? million public-school pupils in the United States.

2. About how many million pupils were there in the public elementary schools in 1900? in 1920? in 1940?

3. By 1960 the number of pupils in the public elementary schools had increased to ? million.

4. In 1900 the number of pupils in public high schools was less than ? million.

5. How many pupils were in public high schools in 1920? 1940? 1960?

6. Has the number of pupils in the elementary schools ever decreased? Has the number in high schools ever decreased?

7. Bring pictograms to school for the class to discuss.

Roman numerals

1. Read these facts about Roman numerals.

I = 1	V = 5	X = 10	L = 50	C = 100	D = 500	M = 1000
VI = 5 + 1 = 6		LX = 50 + 10 = 60			DC = 500 + 100 = 600	
IV = 5 − 1 = 4		XL = 50 − 10 = 40			CD = 500 − 100 = 400	
XI = 10 + 1 = 11		CX = 100 + 10 = 110			MC = 1000 + 100 = 1100	
IX = 10 − 1 = 9		XC = 100 − 10 = 90			CM = 1000 − 100 = 900	

— Read these Roman numerals.

2. VIII XVI XXI XXX

3. CXX DC MC XC

4. XIV XIX XLIV LX

5. XCIX CD CM XL

6. Write the Roman numerals from I to XX.

7. Count by 10's from 10 to 100. Write the Roman numerals for those numbers.

8. Count by 10's from 45 to 135 and write those numbers in Roman numerals.

9. Show that XXIX + XXI = L.

10. Show that C − XL = LX.

11. Below are the Roman numerals from 100 to 1,000 by 100's. Read the numerals and explain how each is formed.

C CC CCC CD D

DC DCC DCCC CM M

— Read these Roman numerals.

12. CCIX MMXL DXXXIX

13. DCCLI CMXC CCCXXVII

— Write in Roman numerals.

14. 411 312 425 542 1,214

15. 772 867 979 635 1,380

16. 645 732 549 153 1,490

17. Below are the Roman numerals from 900 to 2,000 by 100's. Explain how each is formed.

CM M MC MCC

MCCC MCD MD MDC

MDCC MDCCC MCM MM

— Can you read these?

18. MCL MCCL MDXL MCMX

19. MDL MCMV MCCX MCLX

20. Can you read this Roman numeral? MCMXXVII

If you have difficulty, break up the number into parts like this: M—CM—XX—VII.

IT'S CHECK-UP TIME

This test will help you measure what you have learned in Chapter 1. Work carefully. Check your answers. Be sure that every answer is sensible.

1. Copy the number expression that is equivalent to 25.

20×5 $\quad 250 \div 10$ $\quad 31 - 5$

2. Write 50 million using digits.

3. Write a number that is 1 more than 6,990,099.

4. Write a number that is 10,000 less than 110,000.

5. Write 1 billion using digits.

6. In 2,560,000, if you replace the 5 with a 0, the number becomes less by ?.

7. Write the number that falls midway between 200,000 and 300,000.

8. Round 2,399,879 to the nearest million.

9. Begin with 2,800,000 and count by 50 thousands to 3 million.

10. Write CMLX as an Arabic numeral.

— Compute.

11. $10 \times 100{,}000$

12. 10,000 less than 634,815

13. 500,000 more than 1 million

14. 1 million more than 1 billion

15. $10 \times 250{,}000{,}000$

16. $1{,}000 \times 1{,}000$

17. $100{,}000{,}000 \div 10$

18. 5 billion − 100 million

19. 100,000,000 − 50 million

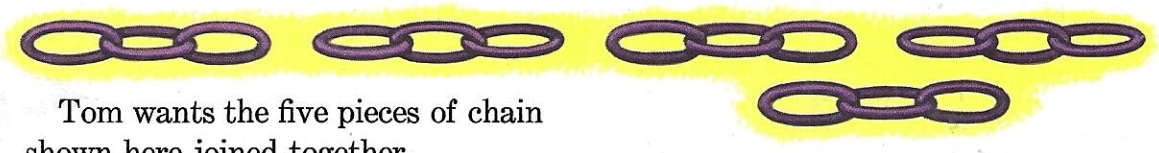
20. $100 \times 100{,}000$

If you have time, try these –

21. Round to the nearest million: 7,530,217,804

22. Write $1\frac{3}{4}$ million using digits.

JUST FOR FUN



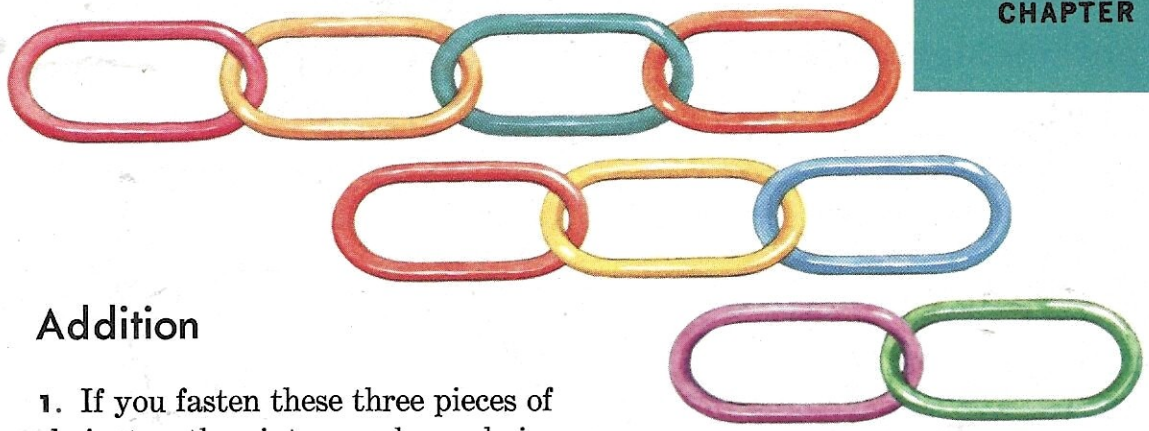
Tom wants the five pieces of chain shown here joined together.

The blacksmith told Tom he would charge 2¢ to cut a link and 6¢ to weld a link, a total cost of 32¢.

Tom said, "You could do it so that my bill would be only 24¢."

Show that Tom was right.

CHAPTER 2



Addition

1. If you fasten these three pieces of chain together into one long chain, it will be ? links long.

- The links show that the *sum* of 4, 3, and 2 is ?.
- The ***addends*** are 4, 3, and ?.
- Does $(4 + 3) + 2 = 4 + (3 + 2)$?

The ***parentheses*** are symbols of grouping.

2. Which grouping of addends below makes the addition easier? Why?

$(37 + 18) + 2$? or $37 + (18 + 2)$?

Does the way addends are *grouped* affect their sum?

3. To make the following additions easier, use the groupings shown. Start at the top. Add down. In Ex. *a* think: "12 + 10 = ?."

a	*b*	*c*	*d*	*e*
4	3	4	7	8
4	7	5	0	8
4	7	2	4	8
5	0	2	8	4
5	8	2	1	4

To check the additions, start at the bottom and add up.

4. What is the sum of 37 and 18? of 18 and 37?

Does the *order* of the addends affect their sum?

5. When you add 28 and 17, you think: "8 and 7 are ?."

$$\begin{array}{r} 28 \\ +\ 17 \\ \hline 45 \end{array}$$

Then you *regroup* the 15 ones into 1 ten and ? ones. The 5 ones stay in the ones column. What do you do with the 1 ten?

6. In this example the sum of the tens is 16 tens. What regrouping is called for? Check the addition.

$$\begin{array}{r} 174 \\ +\ 95 \\ \hline 269 \end{array}$$

7. Write the next four examples.

$$\begin{array}{r} 7 \\ +\ 6 \\ \hline 13 \end{array} \qquad \begin{array}{r} 17 \\ +\ 6 \\ \hline 23 \end{array} \qquad \begin{array}{r} 27 \\ +\ 6 \\ \hline 33 \end{array} \qquad \begin{array}{r} 37 \\ +\ 6 \\ \hline 43 \end{array}$$

MASTERING THE BASIC FACTS

Tell the answers to the Addition Facts Test on page 310.

Then take the test. Write all the answers on folded paper.

Study any facts you miss and take the test again.

Addition practice

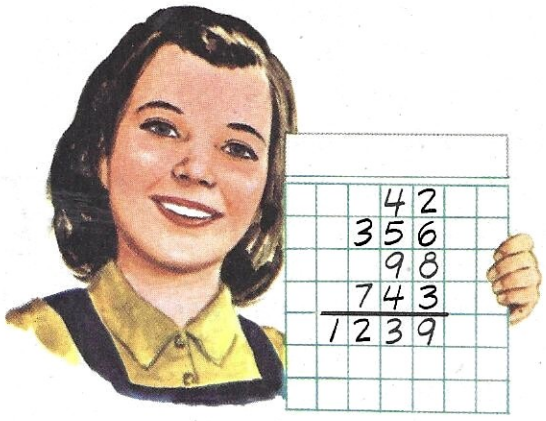
— Add down. Check by adding up. Write your answers on folded paper. Group addends, when you can, to make the addition easier.

	a	*b*	*c*	*d*	*e*
1.	3	6	7	2	9
	5	3	2	5	1
	7	5	4	7	0
	9	3	5	8	6
2.	4	3	8	6	1
	5	6	6	7	3
	9	6	7	8	0
	7	7	8	7	9
	8	9	5	4	2

3. Copy, add, and check.

92	57	32	64	46
78	84	86	76	73
58	41	53	97	89
75	78	65	36	50

4. Jane uses graph paper to keep her columns straight in writing additions. Is her sum correct?



— Copy, add, and check. If necessary, use graph paper to keep columns straight.

5. 25 + 762 + 34 + 905

6. 87 + 9 + 423 + 56

7. 79 + 2462 + 543 + 7

8. 876 + 247 + 1023 + 95

9. 683 + 45 + 706 + 16

10. \$.46 + \$.87 + \$2.43 + \$.95

11. \$10.75 + \$3.94 + \$6 + \$.72

12. \$12.32 + \$4.67 + \$5 + \$.05

13. \$4.62 + \$.73 + \$8.25 + \$10

14. \$12.72 + \$9.46 + \$.75 + \$.09

15. Chester paid \$35.95 for a violin, \$8.79 for a violin case, and \$7.49 for a bow. How much did he spend in all?

16. Find the sum of 425, 682, 75, and 803.

17. Tom bought a pair of ice skates for \$5.98, a pair of wool socks for \$.89, a hockey stick for \$1.69, and a pair of ankle supports for \$1.09. How much did Tom spend in all?

Practice for excellence

Do Practice Set I, page 311.

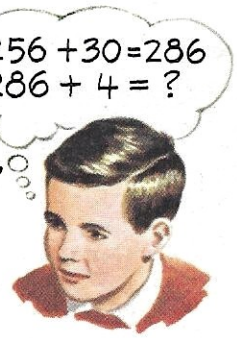
Adding mentally

1. Which of these ways of adding 37 and 28 mentally do you prefer?

- $37 + 28 = 30 + 20 + 7 + 8 = 65$
- $37 + 28 = 37 + 20 + 8 = 65$
- $37 + 28 = 37 + 30 - 2 = 65$

— Add mentally. Use the method that is easiest for you.

	a	*b*	*c*
2.	$40 + 10$	$36 + 12$	$27 + 43$
3.	$50 + 25$	$37 + 18$	$38 + 25$
4.	$92 + 40$	$58 + 14$	$99 + 18$
5.	$30 + 25$	$67 + 23$	$97 + 64$



6. To add 256 and 34, Elmer thought: ⟶ Explain.

— Add mentally.

	a	*b*	*c*
7.	$250 + 49$	$350 + 27$	$250 + 27$
8.	$321 + 35$	$351 + 38$	$342 + 24$
9.	$462 + 26$	$422 + 45$	$403 + 85$
10.	$367 + 40$	$536 + 33$	$811 + 78$
11.	$338 + 21$	$754 + 24$	$372 + 16$
12.	$461 + 41$	$673 + 30$	$285 + 34$

Estimating in addition

1. In this example round each addend to the nearest hundred. 286 rounds *up* to ?. 904 rounds *down* to ?. Estimated sum is ?. Exact sum is ?.

ESTIMATE	
286 →	300
28 →	
385 →	400
904 →	900
281 →	300
+ 95 →	100
1979 →	2000

2. Is $298 + 103 + 99$ about 400, 500, or 600? Think:
It is about $300 + 100 + 100$, or ?.

3. Estimate the sum of $489 + 307 + 50$, rounding the addends to the nearest hundred; to the nearest ten.

4. Would you estimate the total sum of \$12.98, \$2.98, and \$4.00 to be about \$18, or \$19, or \$20?

— Add. Check by estimating.

5. Find the total cost of 3 pairs of woolen socks at 98¢ a pair and a pair of boots at \$3.50.

6. How much is 597 increased by 407?

7. In Freemont School there are 203 fourth graders, 198 fifth graders, and 175 sixth graders.
How many pupils are there in the three grades?

8. Ben and his father traveled 395 miles on Monday, 407 miles on Tuesday, 350 miles on Wednesday, and 401 miles on Thursday.
How far did they travel in all?

Getting ready for addition tests

— Add. Write sums on folded paper. Check.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	68	731	149	$2.98	$4.96	$3.45	$4.56
	72	458	337	1.25	.84	.63	.79
	43	379	58	3.50	.43	.94	.87
	39	604	295	6.00	5.60	6.89	7.98
2.	3278	628	86578	$57.59	$126.93	$315.49	$476.98
	9557	3698	4237	4.35	35.68	73.40	89.79
	1667	589	67958	26.84	794.88	6.75	7.88
	2693	5667	5740	18.05	47.46	23.82	38.99

— Copy, add, and check.

3. 84 + 43 + 96 **4.** 427 + 591 + 86 **5.** $75.38 + $320.79 + $12.49

Addition tests

TEST I

1.	84	**2.**	624	**3.**	436	**4.**	$6.92	**5.**	$9.38
	37		709		94		5.00		2.74
	76		983		62		1.76		.89
	40		165		718		8.49		3.07

6. 99 + 20 + 48 + 54 **7.** 824 + 36 + 987 **8.** 538 + 320 + 79 + 80

Practice for excellence. Do Practice Set II, page 311.

TEST II

1.	6450	**2.**	515	**3.**	60265	**4.**	$75.60	**5.**	$902.75
	1723		7310		4749		2.89		68.63
	5067		989		2523		23.98		9.64
	8908		750		30050		.46		543.20

6. $31.54 + $6.09 **7.** $70.37 + $125.49 + $689.00

Practice for excellence. Do Practice Set III, page 311.

Subtraction

1. Subtraction is the opposite of addition.

- If you add 23 to 37, you get 60.
- If you subtract 23 from 60, you get ?.
- If you subtract 37 from 60, you get ?.

2. In $37 + N = 60$, the addends are 37 and N; the sum is ?.
So $N = 60 - 37$, or ?.

In $N + 23 = 60$, the addends are N and ?; the sum is ?.
So $N = 60 - 23$, or ?.

3. Tom had 80¢. After spending N¢, he had 30¢ left. To find how much he spent, would it be correct to think:

- $N + 30 = 80$?
- $N = 80 - 30$?
- $80 - N = 30$?
- $N + 80 = 30$?

4. Jane had 80¢; she spent 50¢. To find how much she had left, would it be correct to think:

- $N = 80 - 50$?
- $N + 50 = 80$?

5. Bill has 50¢. To buy an 80-cent book, how much more money does he need?

To find how much more Bill needs, would it be correct to think:

$50 + N = 80$, so $N = 80 - 50$?

6. If a is 37, b is 23, and c is 60, does:

- $a + b = c$?
- $b = c - a$?
- $a = c - b$?
- $a + c = b$?

7. Joe weighs 80 lb., and Arthur weighs 65 lb. To find the difference between their weights, would it be correct to think:

- $N = 80 - 65$?
- $80 - N = 65$?
- $65 + N = 80$?
- $N + 80 = 65$?

8. In the subtraction below tell which number is the ***minuend;*** the ***subtrahend;*** the ***difference*** or ***remainder.*** Explain the check.

9. In this example you regroup 6 tens 2 ones into 5 tens 12 ones. Then think:

3 from ? is ?;
4 from ? is ?.

Explain the check.

```
  5 12
  6 2   ← minuend
- 4 3   ← subtrahend
-------
  1 9   ← difference
  ...
  6 2   ← check
```

MASTERING THE BASIC FACTS

Tell the answers to the Subtraction Facts Test on page 312.

Then take the test. Write all the answers on folded paper.

Study any facts you miss, and take the test again.

Make sure that you can write all the remainders correctly and quickly. It is important for you to know these facts.

Subtraction helps

1. To subtract 4557 from 6435, most adults think:

- 7 from 15, 8 (write 8).
- 5 from 12, 7 (write 7).
- 5 from 13, 8 (write 8).
- 4 from 5, 1 (write 1).

$$\begin{array}{r} {\scriptstyle 5\ 13\ 12\ 15} \\ \not{6}\ \not{4}\ \not{3}\ \not{5} \\ -\ 4\ 5\ 5\ 7 \\ \hline 1\ 8\ 7\ 8 \end{array}$$

Check the subtraction.

2. The method in Ex. 1 is correct if 5 thousands 13 hundreds 12 tens 15 ones equal 6435. Are they equal?

Subtract 4557 from 6435 without writing the helping numbers.

3. In this subtraction you may think of 803 as 79 tens and 13 ones. So 7 from ? is ?; 5 from ? is ?; and 2 from ? is ?. Check.

$$\begin{array}{r} {\scriptstyle 7\ 9\ 13} \\ \not{8}\ \not{0}\ \not{3} \\ -\ 2\ 5\ 7 \\ \hline 5\ 4\ 6 \end{array}$$

— Copy, subtract, and check.

	a	*b*	*c*	*d*
4.	287 198	605 287	1856 676	6521 3876
5.	456 238	570 465	3508 2459	8430 6146

6. Explain what has been done in each of these subtractions. Then copy, subtract, and check.

$$\begin{array}{r} {\scriptstyle 5\ 9\ 10} \\ 6\ \not{0}\ \not{0} \\ 2\ 4\ 5 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 8\ 9\ 9\ 10} \\ \not{9}\ \not{0}\ \not{0}\ \not{0} \\ 6\ 2\ 5\ 4 \\ \hline \end{array} \qquad \begin{array}{r} {\scriptstyle 5\ 9\ 9\ 16} \\ 6\ \not{0}\ \not{0}\ \not{0} \\ 2\ 8\ 7\ 8 \\ \hline \end{array}$$

— Copy, subtract, and check.

	a	*b*
7.	400 − 139	500 − 47
8.	8000 − 198	3920 − 856
9.	6400 − 5250	7050 − 375

— Remember to write the dollar signs and cents points in these subtraction examples.

	a	*b*	*c*
10.	\$5.98 2.49	\$4.50 1.98	\$10.00 7.50
11.	\$15.78 8.50	\$37.00 15.75	\$58.09 42.60

12. Copy, subtract, and check.

51546	72346	84237
24557	23457	50348

13. What are the missing numbers?

7	27	36
8	33	43
5	18	?
?	46	28
9	58	49
+6	+ ?	+11
43	200	176

Practice for excellence

Do Practice Set I, page 313.

Subtracting mentally

1. To find 82 − 14 mentally, Ed thinks: "82 − 10 = 72; 72 − 4 = ?."

— Use Ed's method to do these subtractions mentally.

	a	*b*
2.	62 − 15	105 − 32
3.	439 − 11	1000 − 304
4.	73 − 16	154 − 74
5.	569 − 103	1000 − 206
6.	91 − 23	197 − 56
7.	923 − 218	1000 − 550
8.	74 − 35	200 − 63
9.	800 − 203	1000 − 798

— Do these problems mentally. Then check by written subtractions.

10. Tom collects match folders. He has 197 folders, but 25 of them are duplicates. He has only ? folders that are not duplicates.

11. George has $57. If he spends $29, how much will he have left?

12. The pupils in Belmont School want to buy a television set that costs $250. They have $70. How much more must they save?

13. Polly bought 100 sheets of colored paper. She has 27 sheets left. She has used ? sheets.

Estimating in subtraction

1. Would you estimate the difference between 998 and 403 to be about 500, or 600, or 700?

2. Would 2000 − 597 be about 1600, or 1500, or 1400?

3. Would 900 − 249 be about 750, or 650, or 550?

4. Is the difference between 700 and 298 about 300, or 400, or 500?

5. Marie has a ten-dollar bill. The shoes she wants cost $4.89.

She estimates she will have about $6 left if she buys the shoes. Is her estimate correct?

6. Russell has $4.15. He wants a jacket that costs $9.00.

He estimates he needs to earn a little more than $5 before he can get the jacket. Do you agree?

7. Carl estimated that a man who was born in 1891 and died in 1948 lived about 60 years. Was Carl's estimate close?

8. A fast train's speed was 68 miles an hour. A plane's speed was 200 miles an hour.

Did the plane travel about 140, or 130, or 120 miles an hour faster than the train?

Getting ready for subtraction tests

— Subtract. Write remainders on folded paper. Check.

	a	*b*	*c*	*d*	*e*	*f*
1.	465 238	246 95	1036 989	$3.00 1.56	$6.04 3.77	$81.42 56.79
2.	2558 986	1800 893	90340 20768	$90.05 35.75	$200.00 18.97	$800.00 359.88

— Copy, subtract, and check.

	a	*b*	*c*	*d*
3.	876 − 432	509 − 93	1554 − 748	$10.60 − $5.79
4.	1874 − 956	7632 − 5418	2369 − 1645	$49.25 − $31.50
5.	3790 − 1782	16210 − 6935	50800 − 989	$900 − $459.98

Subtraction tests

TEST I

1.	2.	3.	4.	5.
89 54	90 37	406 283	760 94	$9.38 7.54

6. 46 − 28 **7.** 283 − 109 **8.** $5.00 − $2.76 **9.** 200 − 189 **10.** $7.04 − $5.16

Practice for excellence. Do Practice Set II on page 313.

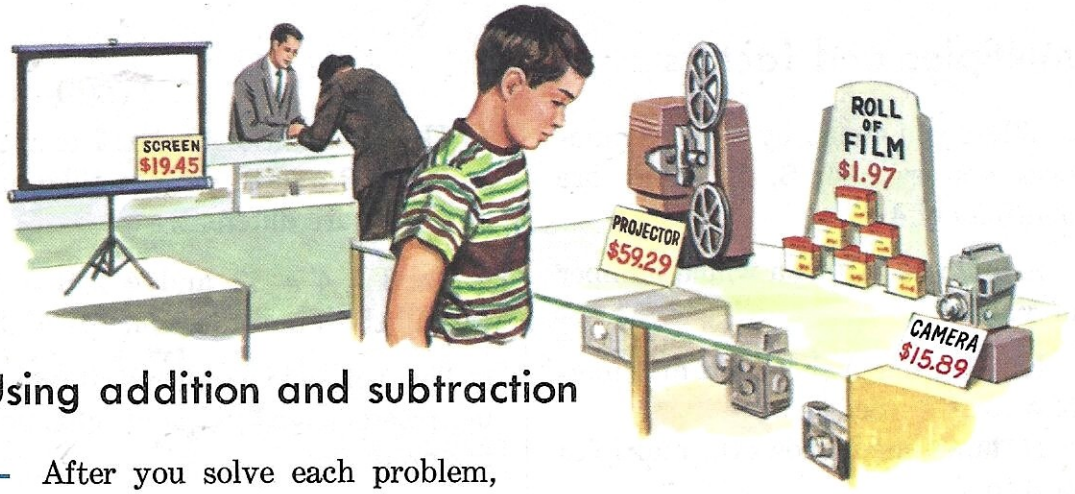
TEST II

1.	2.	3.	4.	5.
6573 868	$70.59 36.73	1500 898	12655 6859	$675.00 248.25

6. 2468 − 1283 **7.** 2000 − 1987 **8.** 9790 − 1685

9. 12005 − 6859 **10.** $196.09 − $14.92 **11.** $86 − $50.79

Practice for excellence. Do Practice Set III on page 313.



Using addition and subtraction

— After you solve each problem, check the answer. Is it sensible?

1. The Sports Shop is having a sale. Find the total cost of a movie camera, projector, screen, and roll of film at the sale.

2. Douglas has $14.63 in his school savings account. If he takes out $6.89, how much will he have left?

3. Arthur's home is heated by an oil burner. On November 1 the oil tank had 512 gallons of oil in it.

On December 1 there were only 289 gallons left in the tank. How much oil was used during November?

4. Billy has flown 900 miles in an airplane. Martha has flown 643 miles. Billy has flown ? miles more than Martha.

5. A typewriter regularly priced at $80 was marked down to $76.29. How much was the price reduced?

6. Columbus discovered America in 1492. How many years ago was that?

7. Gus has a 316-page history book to read. He has read 178 pages. How many more pages does he have to read?

PROBLEM SOLVING HELP

— Fred made up these puzzles. Find the unknown number, N, in each puzzle. Then make up some puzzles for your class to work.

	a	*b*	*c*	*d*
8.	34 − N = 17	50 − N = 28	100 − N = 30	92 − N = 47
9.	N − 27 = 63	N − 350 = 650	N − 27 = 313	N − 3 = 197

10. $N - (13 + 9) = 75$

Think twice!

Fred is saving to buy a science kit for $30. His father has promised to contribute a dollar for every dollar Fred earns.

Fred now has earned $12.66. How much more does he need to save?

Multiples and factors

When you count by 4's, the numbers you say (4, 8, 12, etc.) are *multiples* of 4.

A ***multiple*** of 4 is a whole number of 4's.

Number line A shows the multiples of 4 to ?. (See below.)
Number line B shows the multiples of 8 to ?.

— Use the number lines to answer Exs. 1 to 9.

1. Is every multiple of 8 also a multiple of 4?

2. Is every multiple of 4 also a multiple of 8?

3. How does number line A show the multiplication facts of 4?

4. How does number line B show the multiplication facts of 8?

5. Can multiples of 8 be divided exactly by 8? $96 \div 8 =$?

6. Begin with 12 and name the multiples of 12 to 60.

7. $4+4+4+4+4+4+4+4=$?
$8+8+8+8=$?

8. Use the additions in Ex. 7 to show how 4×8 and 8×4 are alike and how they are different.

9. In $8 \times 4 = 32$ and $4 \times 8 = 32$ we call the 4 and the 8 ***factors*** of 32.

The factors in a multiplication can be interchanged without changing the product.

10. One pair of factors of 12 is 3 and 4. Name another pair.

11. One pair of factors of 15 is 5 and ?.

12. Name a pair of factors of 14. What two multiplication facts can you write with them?

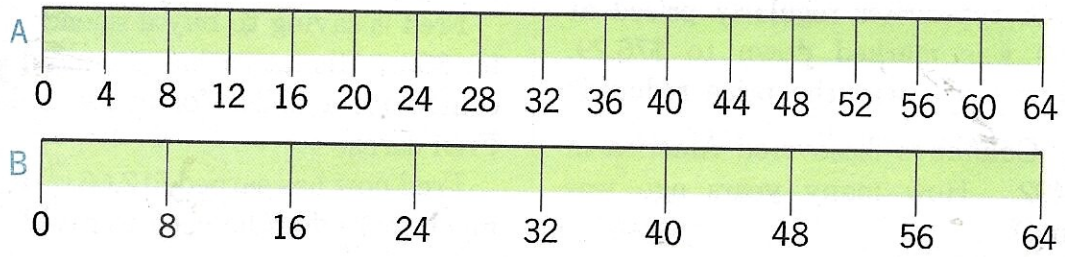
13. How many pairs of factors other than 1 and 24 can you find for 24?

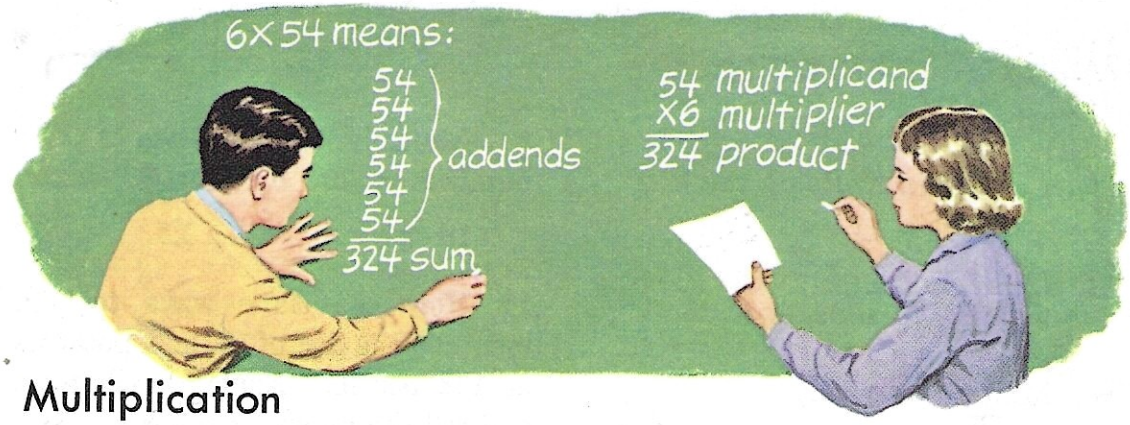
14. 7 and 7 are factors of ?.

— Which of these statements do you believe to be true?

15. Every multiple of 10 is also a multiple of 5.

16. Every multiple of 5 is also a multiple of 10.





Multiplication

1. To find 6×54, Peter used 54 as an addend ? times. The sum of the 6 addends is ?.

2. When you find six 54's by multiplying, 54 is called the ***multiplicand***. What number is the ***multiplier***? the ***product***?

3. Does 6×12 equal

$$(6 \times 10) + (6 \times 2)?$$

4. If you know that $10 \times 9 = 90$, then you know that $9 \times 9 = 90 -$?.

5. Explain both of these methods for finding 20×18.

- $10 \times 18 = 180$; $2 \times 180 = 360$.
- $2 \times 18 = 36$; $10 \times 36 = 360$.

6. Multiply each by 20; by 30; 50.

6 19 42 60 125

7. Any number times zero = ?.
Zero times any number = ?.

8. Can any addition example be done by multiplication? Illustrate.

Can any multiplication be done by addition? Illustrate.

9. 6×28 may be read "6 times 28" or "28 multiplied by 6."

Is 6 the multiplier in both ways of reading the sentence?

10. If you know the cost of 1 pencil how would you find the cost of a given number of pencils?

11. In $20 \times 32 = 640$, name the factors; the product; the multiplier; the multiplicand.

12. If one of the factors is zero, the product is ?.

MASTERING THE BASIC FACTS

Tell the answers to the Multiplication Facts Test on page 314.

Then take the test. Write all the products on folded paper.

Study any facts you miss, and take the test again.

Make sure that you can write all the products correctly and quickly. It is important for you to know these facts.

Multiplying mentally

1. To find the cost of 6 pads of paper at 23¢ each, Ralph thinks:

$6 \times 20¢ = \underline{?}\ ¢$
$6 \times 3¢ = \underline{?}\ ¢$
$6 \times 23¢ = 138¢$, or \$1.38

— Multiply mentally.

	a	*b*	*c*
2.	$8 \times 35¢$	$9 \times 23¢$	$7 \times 35¢$
3.	$9 \times 22¢$	$8 \times 65¢$	$9 \times 53¢$
4.	7×67	8×48	9×64
5.	7×800	4×208	5×209
6.	4×510	6×370	4×125

7. Show that these three number expressions are equivalent.

- 6×48
- $6 \times (40 + 8)$
- $(6 \times 40) + (6 \times 8)$

8. To find 20×13 mentally, you can multiply 13 by factors of 20 (10 and 2). Explain these two ways of finding 20×13. Which way seems easier to you?

- $10 \times 13 = 130$; $2 \times 130 = \underline{?}$.
- $2 \times 13 = 26$; $10 \times 26 = \underline{?}$.

9. Use factors of 30 to find:

30×12 30×15 30×25

10. Use factors of 300 to find:

300×12 300×14 300×25

11. Multiply mentally each of these numbers by 20; by 200; 40; 400.

15 41 23 32

12. Here are three ways to find mentally the cost of 15 lb. of potatoes at 13¢ per lb. Explain each way, and tell the missing numbers.

- $10 \times 13¢ = 130¢$
  $5 \times 13¢ = 65¢$
  $15 \times 13¢ = 195¢$, or $\underline{?}$

- The factors of the multiplier 15 are 5 and 3.
  $5 \times 13¢ = 65¢$; $3 \times 65¢ = \underline{?}\ ¢$, or $\underline{?}$.

- The factors of the multiplier 15 are 3 and 5.
  $3 \times 13¢ = 39¢$; $5 \times 39¢ = \underline{?}\ ¢$, or $\underline{?}$.

13. To find 6×127, think:

$6 \times 100 = 600$
$6 \times 20 = 120$
$6 \times 7 = 42$
$6 \times 127 = \underline{?}$

— Use the method of Ex. 13 to find:

14. 3×125 4×136 6×120

15. 3×131 4×145 6×124

16. 4×135 4×212

17. Do Exs. 14 to 16 as written examples. →

$$\begin{array}{r} 125 \\ \times\ 3 \\ \hline 375 \end{array}$$

Practice for excellence

Do Practice Set I, page 315.

Writing multiplications

1. Two factors of the multiplier in this multiplication are 10 and ?.

In the product, which digit or digits show that 36 has been multiplied by the factor 10? by the factor 2?

$$\begin{array}{r} 36 \\ \times 20 \\ \hline 720 \end{array}$$

— Copy and multiply.

	a	*b*	*c*	*d*
2.	36	49	72	85
	20	40	60	90
3.	75	86	95	87
	50	70	40	50

4. Two factors of the multiplier in this multiplication are 100 and ?.

In the product, which digits show that 245 has been multiplied by the factor 100? by the factor 3?

$$\begin{array}{r} 245 \\ \times 300 \\ \hline 73,500 \end{array}$$

— Copy and multiply.

5.	245	389	654	205
	400	700	800	600
6.	947	375	470	270
	400	500	300	900

7. Allowing 365 days to a year, how many days are there in a century? in 2 centuries?

8. Below are two ways of writing a multiplication to find 24 × 36.

A	B
36 ← multiplicand →	36
× 24 ← multiplier →	× 24
144 ← partial product →	144
720 ← partial product →	72
864 ← product →	864

- How do you find the first partial product in Ex. A? in Ex. B? In both, the first partial product is ?.

- How do you find the second partial product in Ex. A? in Ex. B? How do they differ? Why can 720 be written in Ex. B using only two digits? In both examples, the product is ?.

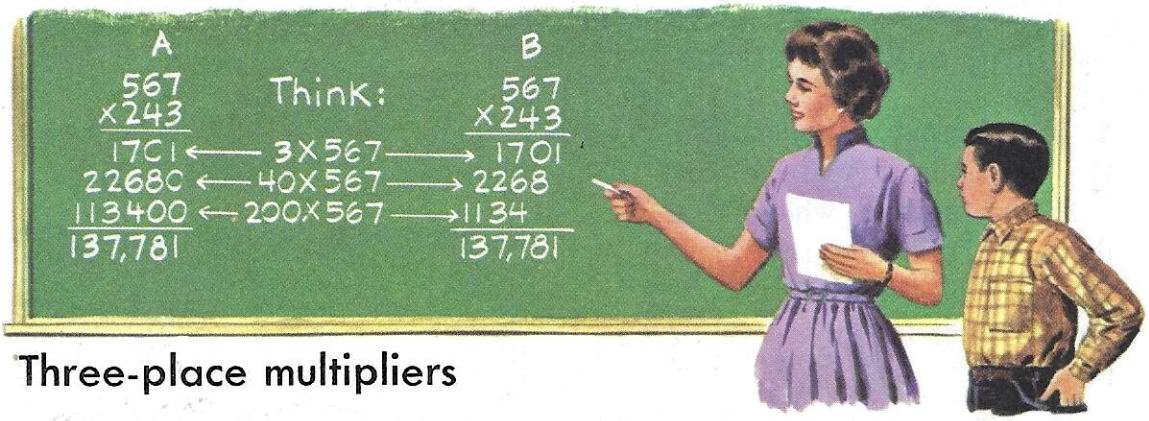
- How can you check the work?

— Multiply. Check Ex. 9 by interchanging multiplicand and multiplier. Check Ex. 10 by going over your work.

	a	*b*	*c*	*d*
9.	73	73	73	85
	64	37	58	64
10.	406	129	875	903
	58	37	64	98

Practice for excellence

Do Practice Set II, page 315.



Three-place multipliers

On the board are two ways of writing a multiplication to find 243×567.

- How do you find the first partial product in Ex. A? in Ex. B?
- How do you find the second partial product in Ex. A? in Ex. B? How do they differ? Why can you omit the writing of the zero in Ex. B?
- How do you find the third partial product in Ex. A? in Ex. B? How do they differ? Why can you omit the writing of the two zeros in Ex. B?
- If the multiplier and the multiplicand were to be interchanged, would the partial products be different? Try it and see.

— Copy and multiply. Check.

	a	*b*	*c*
1.	129 286	406 286	406 904
2.	708 600	869 700	578 401
3.	\$9.87 400	\$5.03 800	\$4.80 656
4.	\$7.63 286	\$7.63 904	\$5.78 249

Practice for excellence

Do Practice Set III, page 315.

Thinking about factors

— Show that the two products in each example are equivalent.

	a	*b*
1.	$(5 \times 4) \times (3 \times 2)$	$5 \times (4 \times 3 \times 2)$
2.	$(4 \times 5 \times 6) \times 7$	$4 \times (5 \times 6 \times 7)$
3.	$6 \times (7 \times 8 \times 9)$	$(6 \times 7) \times (8 \times 9)$

4. Could you use these solutions to find $5 \times 13 \times 4 \times 10$?
   - $(5 \times 13) \times (4 \times 10)$
   - $(5 \times 4) \times (13 \times 10)$

Factors may be grouped and the order changed in any way without changing the product.

Estimating and finding products

Lucy has invited 22 of her friends to her birthday party. She would like to buy some party favors costing 27¢ each. She is trying to estimate how much they will cost. This is the way Lucy made her estimate.

- $22 \times 27¢$ is about $20 \times 30¢$.
- 10 and 2 are factors of 20.
- $10 \times 30¢ = \$3.00$; $2 \times \$3 = \$6$.

Lucy said, "The favors will cost about \$6." How far off was her estimate?

— Study Exs. 1 to 4 to see how each product is estimated. Complete the estimate. Then copy the example and find the exact product.

	Example	Rounded	Think
1.	53	50	
	36	40	$(10 \times 50) \times 4$
2.	69	70	
	32	30	$(10 \times 70) \times 3$
3.	287	300	
	48	50	$(10 \times 300) \times$?
4.	4239	4000	
	19	20	$(10 \times$? $) \times$?

In estimating products, round:

- 2-place factors to tens.
- 3-place factors to hundreds.
- 4-place factors to thousands.

— Estimate these products. Then copy and find the exact products.

	a	*b*	*c*
5.	84	119	309
	57	29	22
6.	3178	\$9.87	\$7.97
	27	60	48

7. When you round 37×60 to 40×60, your estimate (2400) is too large. Show that the estimate is too large by 3×60, or 180.

8. When you round 32×80 to 30×80, your estimate (2400) is too small. How much too small is it?

Think twice!

9. When you round 32×81 to 30×80, your estimate is too small. Can you find how much too small without multiplying 32×81?

10. When you estimate a product by rounding up both factors, is your estimated product sometimes too large or always too large?

11. When you estimate a product by rounding down both factors, is your estimated product sometimes too small or always too small?

12. Is your estimated product ever equal to the exact product when you round one factor *up* and the other factor *down*? Illustrate.

Getting ready for multiplication tests

— Copy and multiply. Check your work.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	67 × 68	95 × 74	68 × 76	129 × 68	\$9.78 × 54	\$7.63 × 59	\$8.97 × 89
2.	406 × 79	239 × 586	509 × 807	\$8.97 × 325	\$7.04 × 678	\$5.70 × 489	\$6.78 × 567

	a	*b*	*c*	*d*	*e*
3.	85 × 74	68 × 76	89 × 139	76 × \$8.97	89 × 68
4.	289 × 376	903 × 508	50 × \$8.09	600 × \$4.79	700 × \$8.97

Multiplication tests

— Copy, multiply, and check. Try to get a perfect score on each test.

TEST I

1. 64 × 78	2. 89 × 76	3. 897 × 65	4. 987 × 49	5. 593 × 88

6. 47 × 96 7. 39 × 89 8. 47 × 318 9. 84 × 269

Practice for excellence. Do Practice Set II on page 315.

TEST II

1. 406 × 38	2. 978 × 476	3. 609 × 208	4. 879 × 800	5. \$9.06 × 508

6. 498 × 379 7. 506 × 708 8. 300 × \$6.97 9. 401 × \$7.89

Practice for excellence. Do Practice Set III on page 315.

Problem solving

— Check each answer. Is it sensible?

1. Find the cost of supplying a spelling book to each of 29 pupils, if the spellers cost $.69 each.

2. Louise spent 65¢ for a roll of film for her camera. She spent 40¢ to have the film developed, and 12¢ apiece to have each of the 8 pictures printed.

How much did the 8 pictures cost all together?

3. Dan's uncle sent him $5.00 for his birthday. How much will Dan have left if he buys 3 tubes for his radio at $1.29 each?

4. Polly had $4.78. She lost 2 coins. Now she has only $4.43. Can you tell what coins she lost?

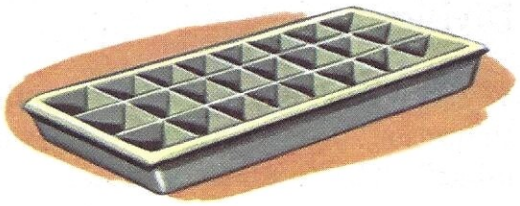
5. George filled 8 egg crates for his father. Each crate holds 12 dozen eggs. How many eggs did George pack all together?

6. Alice Ann has $2.17. How much more does she need to buy 4 records at 98¢ each?

7. Bruce can get a set of eight 89-cent recordings for $6.15.

How much can he save by buying the set of 8, instead of buying the 8 records one at a time?

8. Bob has read 87 pages of his book, *Flaming Arrows*. The book has 178 pages. He has ? more pages to read.



9. The electric refrigerator in Janet's home has 3 of these ice-cube trays. How many ice cubes can Janet make at one time?

10. For working 9 hours at $.65 an hour, Joe will receive ?.

11. Grace can get a new Girl Scout dress for $6.95. She can buy Ruth's outgrown dress for $3.50. How much can Grace save by buying Ruth's dress?

12. Martha earned $1.90 for baby-sitting, $.15 for doing an errand, and $1.50 selling greeting cards. How much did she earn in all?

13. The record broad jump for a man is 26 ft. 8 in. A kangaroo can easily jump 30 ft., or ? ft. ? in. farther than a man.

14. How much change should Peter get from a ten-dollar bill if he buys 3 pairs of socks at 79¢ a pair?

Think twice!

Can you solve these puzzles? Make up some like them for the class to solve.

8?	8?7	?54	78?
× ?	× ?	?	9
425	4842	4270	???6

Division

1. Harry said, "I can change a multiplication table into a division table." This is what he wrote:

$6 \times 9 = 54$, so $54 \div 9 = 6$, $54 \div 6 = 9$

$7 \times 9 = 63$, so $63 \div 9 = 7$, $63 \div 7 = 9$

Give other illustrations of how multiplication facts lead to division facts.

2. Jane said, "A division table *undoes* a multiplication table." Give an example to show what she meant.

3. Anita said, "When I want to divide 59 by 9, I think:

"What number $\times 9 = 59$? I remember that $6 \times 9 = 54$. So I see this." ⟶

$$9\overline{)59}\quad 6,\ 54,\ 5$$

The division shows that $59 \div 9 = 6$ with a remainder of 5.

Give illustrations of other divisions with remainders. Show how to check your divisions.

4. Lois said, "I suppose everybody knows that zero divided by 2, or 3, or any number, is zero."

Show that Lois is right.

5. Martin said, "I use common sense in division. I divide 936 by 9 this way."

$$900 \div 9 = 100$$
$$36 \div 9 = 4$$
$$\text{so } 936 \div 9 = 104$$

Divide, using Martin's method.

$848 \div 8$ $624 \div 3$ $1216 \div 4$

6. Dick said, "You can use division to find the missing multiplicands or multipliers in examples like these."

- $9 \times N = 72$; so $N = 72 \div 9$, or 8.
- $N \times 8 = 56$; so $N = 56 \div 8$, or 7.

7. Grace thought of another way to say what Dick said.

- In multiplication:

  factor × *factor* = *product*.

- In division:

  product ÷ *one factor* = *other factor*.

- $N \times 8 = 32$; so $N = 32 \div 8$, or $\frac{?}{}$. Give other illustrations.

MASTERING THE BASIC FACTS

Tell the answers to the Division Facts Test on page 316.

Then take the test. Write all the answers on folded paper.

Study any facts you miss and take the test again.

Make sure that you can write all the answers correctly and quickly. It is important for you to know these facts.

Division helps

1. George Scott flew his plane 948 miles in 5 hours.

• Would you estimate his average rate to be more than 100 miles an hour? as much as 200 miles an hour?

• To find the average rate, George divided as shown below. Explain his work.

quotient → 189 r3 ← remainder
divisor → 5)948 ← dividend

	check
5	
44	189
40	× 5
48	945
45	+ 3
3 remainder	948

• How did George check his division?

• In George's problem, 948 is the ___?___; 5 is the ___?___; 189 is the ___?___; and 3 is the ___?___.

2. In the division $9\overline{)6350}$, how can you tell at a glance that the quotient must be more than 10? more than 100? less than 1000?

• How does knowing $63 \div 9 = 7$ give you a hint that the quotient to $6350 \div 9$ is a little more than 700?

• Do the division and check.

3. What is the first quotient figure in each of these divisions?

$7\overline{)6293}$ $6\overline{)786}$ $9\overline{)496}$

• How many places are there in each quotient?

• Where will you write the first quotient figure in each division?

• Find the quotient of each.

— In Exs. 4 to 6 estimate the quotient. Then copy, divide, and check.

	a	*b*	*c*
4.	$5\overline{)78}$	$4\overline{)317}$	$5\overline{)518}$
5.	$7\overline{)104}$	$9\overline{)760}$	$7\overline{)509}$
6.	$6\overline{)5440}$	$8\overline{)7768}$	$9\overline{)5640}$

7. To divide \$756 by 7, think:

\$700 ÷ 7 = \$100
\$ 56 ÷ 7 = \$ 8
so \$756 ÷ 7 = \$___?___

8. To divide \$44.64 by 6, Judy wrote: ⟶ Check her division.

```
  $ 7.44
6)$44.64
  42
   26
   24
    24
    24
```

— Remember to write the dollar signs and cents points in these examples.

9.	$9\overline{)\$8.37}$	$7\overline{)\$4.83}$	$8\overline{)\$6.26}$
10.	$6\overline{)\$5.09}$	$9\overline{)\$66.50}$	$9\overline{)\$86.18}$

Practice for excellence

Do Practice Set I, page 317.

Estimating and finding quotients

1. Answer the following questions about this example.

$7\overline{)5645}$

- Is the quotient more than 10? (10 sevens = ?)
- Is the quotient more than 100? (100 sevens = ?)
- Is the quotient more than 1000? (1000 sevens = ?)
- Is the quotient a 2-figure or a 3-figure number? Why?
- What is the first quotient figure?
- Is a sensible estimate of the quotient 80, or 800, or 8000?

2. Is $6325 \div 9$ about 70, about 700, or about 7000?

3. Is $5\overline{)986}$ about 10, about 100, or about 200?

4. Is $6\overline{)563}$ about 90, about 900, or about 800?

5. In the division $7\overline{)6293}$, must the quotient be more than 100? less than 1000? Why? Is the quotient a 3-figure number?

Would 900 be a sensible estimate of the quotient? Why?

6. In which of these divisions is the quotient figure too large?

9	8	9	8
$9\overline{)85}$	$9\overline{)66}$	$7\overline{)68}$	$8\overline{)69}$
81	72	63	64

— In each division below tell how many figures there will be in the quotient; tell the first figure of the quotient; estimate the quotient.

	a	*b*	*c*
7.	$5\overline{)4290}$	$5\overline{)4462}$	$5\overline{)460}$
8.	$6\overline{)4782}$	$6\overline{)4807}$	$6\overline{)6900}$
9.	$7\overline{)6350}$	$7\overline{)6256}$	$7\overline{)8400}$
10.	$8\overline{)600}$	$8\overline{)6000}$	$8\overline{)3785}$
11.	$9\overline{)2087}$	$9\overline{)9081}$	$9\overline{)687}$

12. Work and check Exs. 7 to 11.

— Copy, divide, and check.

13.	$8\overline{)5631}$	$6\overline{)5424}$	$7\overline{)5730}$
14.	$9\overline{)5410}$	$8\overline{)7300}$	$7\overline{)6400}$
15.	$6\overline{)5390}$	$9\overline{)8108}$	$8\overline{)7210}$
16.	$7\overline{)7000}$	$8\overline{)8000}$	$9\overline{)9000}$

Think twice!

— Look at each division; then see if you can answer the question without reworking the example.

17. By how much must the dividend be increased to give a quotient of 80?

$$\begin{array}{r} 70 \\ 7\overline{)490} \end{array}$$

18. By how much must the dividend be decreased to give a quotient of 50?

$$\begin{array}{r} 61 \\ 6\overline{)366} \end{array}$$

Finding averages

1. The Safety Committee of the Wilson School made a traffic check to see how many parents brought children to school by car each morning. They decided that the check should run for several days. Why?

2. The first day they counted 67 cars; the second day, 61; and the third day, 70.

▶ To find the average number of cars, first they added the counts for the 3 days. $(67 + 61 + 70 = \underline{?})$

▶ Then they divided the sum by 3. $198 \div 3 = \underline{?}$. The average number of cars per day was $\underline{?}$.

3. Another survey during the following week gave counts of 62, 58, and 63 cars. What is the average number per day for the second week?

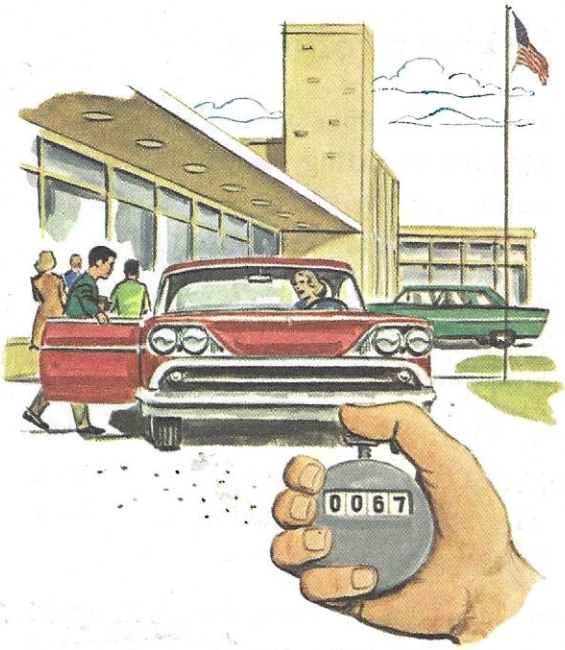
4. How would you compare the average number of cars during the first week and the second week?

5. The average reading rate of sixth-grade pupils is 170 words per minute.

In a 5-minute reading test, a group of sixth graders read the following numbers of words.

David W.	850	Thomas W.	795
Fay S.	845	Leroy G.	829
Sylvia P.	860	Robert P.	910
John K.	871	Mary J.	789

Which pupils are below average? above average? average?



6. How could you find out the average number of words you read per minute?

7. Is the average of several different numbers always *less* than the *largest* number? Is it always *larger* than the *smallest* number?

Does it always lie between the largest and the smallest numbers?

8. Marty and Earl say that they have the same average score on four arithmetic tests. Check by finding the average score for each.

Arithmetic Test Scores	
Marty	Earl
85	75
80	100
85	95
90	70

• Explain how such different scores give the same average.

• How would you think to estimate Marty's average score? to estimate Earl's average score?

Solving problems

1. Bill's brother used 2 gallons of gasoline in riding his motorcycle 78 miles. How many miles did he travel on a gallon of gasoline?

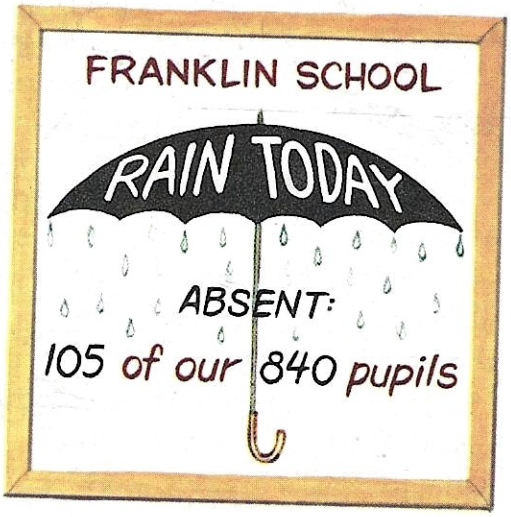
2. Eight boys made a radio costing $10.96. If they share the cost equally, how much should each pay?

3. There are 6 buses to take 192 pupils to visit the Westtown Airport. The buses are the same size. How many should ride in each bus?

4. On Visiting Day, the sixth grade is going to serve orange juice. One can of frozen orange juice makes 6 glasses. How many cans should they buy to make 78 glasses?

5. If a plane ticket for an adult costs $105.00, what does a half-fare ticket for a child cost?

6. How many pupils are present at Franklin School today?



7. If 6 boys share equally 114 stamps, each will get $\frac{?}{}$ stamps.

8. How many 5-cent popcorn balls can you buy for 95¢?

9. In Pine City the schools are open 195 days a year.

If there are 5 school days in a week, how many weeks are the schools open each year?

10. You know how many weeks there are in a year. Can you tell how many weeks of vacation Pine City pupils (Ex. 9) have each year?

11. Your teacher or principal can tell you how many days you go to school each year.

Figure out how many weeks of school you have each year; how many weeks of vacation.

12. How many 8-inch lengths can you cut from 4 yards of string?

13. Five boys were playing with Mr. Grant's rowboat. They broke an oar. The repairs cost $1.75.

If the boys share the expense equally, how much should each pay?

14. Tom has a wooden pole 10 feet long. He wants to cut it into pieces 8 inches long.

How many cuts will he have to make? (This is a tricky problem.)

Number sentences

1. How many 6-cent pencils can be bought for 24 cents?

To solve this problem, which of these ways of thinking seems better to you? Why? (Both are correct.)

- Number of pencils $\times$ 6¢ = 24¢
- N $\times$ 6 = 24

2. In N $\times$ 6 = 24, the unknown multiplier is N; the known multiplicand is ?; the known product is ?.

3. To find the unknown multiplier in N $\times$ 6 = 24, divide the known ? by the known ?. N = ?

4. How many dozen eggs are there in 72 eggs?

To solve this problem, which of these ways of thinking seems better to you? Why?

- Number of dozen $\times$ 12 = 72
- N $\times$ 12 = 72

5. In N $\times$ 12 = 72, what is the multiplier? multiplicand? product?

Which is unknown? known?

6. In N $\times$ 12 = 72, how do you find the unknown multiplier, N? N = ?

— Find the unknown multiplier, N, in Exs. 7 to 9.

	a	*b*
7.	N $\times$ 4 = 48	N $\times$ 8 = 96
8.	N $\times$ 9 = 720	N $\times$ 7 = 7007
9.	N $\times$ 9 = 1800	N $\times$ 6 = 1500

10. What is the cost of 1 pencil when 6 pencils cost 30 cents?

To solve this problem, which of these ways of thinking seems better?

- 6 $\times$ cost of 1 pencil = 30¢
- 6 $\times$ N = 30

PROBLEM SOLVING HELP

11. In 6 $\times$ N = 30, what is the multiplier? the multiplicand? the product?

Is the multiplier known or unknown? the multiplicand? the product?

12. In 6 $\times$ N = 30, how do you find the unknown multiplicand, N?

— Find the unknown multiplicand, N, in each of these number sentences.

	a	*b*
13.	6 $\times$ N = 540	7 $\times$ N = 840
14.	8 $\times$ N = 720	9 $\times$ N = 6300

— Write a number sentence for each of Exs. 15 to 19.

15. Five pupils shared equally the cost of a 4-dollar picnic. Each pupil's share was ?.

16. How many 25-cent tickets can be bought for 8 dollars?

17. How many yards are there in 24 feet?

18. How many dozen are there in 84?

19. How many teams of 5 players each can be formed with 30 players?

Two-figure divisors

Miss Stone's sixth grade has decided to cover their bulletin board with green burlap. By measuring, they found that they will need a strip of burlap 108 inches long.

Carl said, "The burlap is sold by the yard. How many yards of burlap do we need?"

Judith said, "There are 36 inches in 1 yard. We have to find how many 36-inch lengths there are in 108 inches."

Carl, Judith, and George used different ways to find how many 36's there are in 108. Study them. Then decide whose way you prefer.

1 Carl started with 108 inches and subtracted 36 over and over as many times as he could. He found that there are ? 36's in 108. So he said, "We'll need ? yards of burlap."

```
 108
- 36✓
  72
- 36✓
  36
  36✓
-----
   0
```

2 Judith made a Helping Table to find how many 36's there are in 108. Why didn't she need to make her table any longer than this?

1 × 36 =	36
2 × 36 =	72
3 × 36 =	108

Her table shows that it takes ? 36's to make 108. She found they will need ? yards of burlap.

3 George found how many 36's there are in 108 by dividing 108 by 36, like this. ⟶

```
   3
36)108
   108
```

▶ He estimated the quotient by thinking, "There are probably as many 36's in 108 as there are 3's in 10. $10 \div 3 = 3$ r1 gives me a *hint* that the quotient is 3."

▶ He wrote the quotient, 3, in its place over the 8 in the 108.

▶ He multiplied: $3 \times 36 = 108$. He wrote the 108 under the 108.

▶ He subtracted 108 from 108. Was there any remainder?

His work shows there are ? 36's in 108. It shows that the pupils will need ? yards of burlap.

▶ Check: Do 3 yards = 108 inches?

Did Carl, Judith, and George get the same answer?

1. Most sixth-grade pupils would find how many 36's there are in 108 by dividing, as George did.

Why is George's way better than Carl's and Judith's?

2. Are there as many as ten 31's in 283? $(10 \times 31 = \text{?})$

31)283

3. To estimate the quotient in Ex. 2, George thought, "There are probably as many 31's in 283 as there are 3's in 28.

"$28 \div 3$ gives me a *hint* that there are ? 31's in 283."

4. Copy the division in Ex. 2, divide, and check.

5. What helping division fact will you use to estimate the quotient in this example: 42)93?

Copy, divide, and check.

— Estimate the quotients. Then copy, divide, and check.

	a	*b*	*c*	*d*	*e*
6.	25)78	42)176	51)383	24)99	43)235
7.	60)190	33)204	22)136	43)188	42)264
8.	34)178	43)221	13)28	12)49	13)29
9.	30)175	22)112	22)53	33)269	42)300
10.	44)98	32)174	41)293	22)139	32)206
11.	34)170	24)96	42)294	53)215	23)139

Estimating two-figure quotients

Miss Norton's class is giving a concert. There are 336 seats in the school auditorium; so Dan and Joyce are to make 336 tickets.

They can make 24 tickets from one sheet of cardboard. They wonder how many sheets of cardboard they should buy.

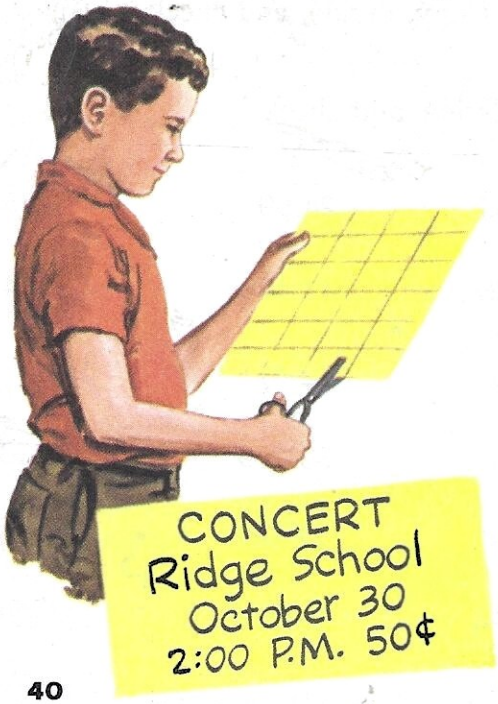
1. Dan said, "*Some number* (of sheets of cardboard) $\times 24 = 336$."

Joyce said, "That's right. I think: $N \times 24 = 336$; so $N = 336 \div 24$."

Was Joyce's thinking correct?

2. Before dividing 336 by 24, Dan decided that the quotient was more than 10. How did he know?

3. If they bought 10 sheets, how many tickets could they make? Do they need more than 10 sheets?



4. Explain Dan's division below. How does he get the 10? the 240? the 96? the 4? How many sheets did he find were needed?

Dan	Joyce
4 } 14 1 0 } 24)336 240 96 96	14 24)336 24 96 96

5. Explain Joyce's division. How is it like Dan's? How is it different?

6. Check their answer. If they can get 24 tickets from one sheet, how many can they make from 14 sheets?

7. Is the quotient of $15\overline{)165}$ more than 10? as much as 20? Why?

8. Is the quotient of $51\overline{)1139}$ more than 10? more than 30? close to 20? Estimate it.

9. Is the quotient of $84\overline{)1986}$ more than 10? close to 20? Why?

10. If a quotient is more than 10 but less than 100, is it a 2-figure number?

11. Tom said he could tell by looking at $91\overline{)3761}$ that the quotient is a 2-figure number, somewhere in the forties. How could he tell that?

Finding two-figure quotients

To divide 768 by 32, first estimate. Is the quotient a 2-figure number? Is it more than 10? more than 20?

To divide, use the following steps.

▶ Estimate the first quotient figure. How many 3's in 7? Write 2 in tens place. Why?

▶ Multiply: $2 \times 32 = 64$. Write the 64 under the 76.

▶ Compare: Can 64 be subtracted from 76?

▶ Subtract: $76 - 64 = 12$.

▶ Bring down the 8.

▶ Divide 128 by 32. Estimate the quotient figure. $12 \div 3 = \underline{?}$. Write the 4 in ones place.

▶ Multiply: $4 \times 32 = 128$. Write the 128 under the 128.

▶ Compare: Can 128 be subtracted from 128?

▶ Subtract: $128 - 128 = 0$.

▶ Check: Does $24 \times 32 = 768$?

$$\begin{array}{r} 24 \\ 32\overline{)768} \\ 64 \\ \hline 128 \\ 128 \\ \hline \end{array}$$

— Estimate the quotient. Then copy, divide, and check.

	a	*b*	*c*
1.	$41\overline{)943}$	$51\overline{)663}$	$72\overline{)6227}$
2.	$42\overline{)2730}$	$32\overline{)2304}$	$82\overline{)6902}$
3.	$51\overline{)3631}$	$72\overline{)4048}$	$62\overline{)2046}$
4.	$91\overline{)2457}$	$61\overline{)5197}$	$71\overline{)5262}$
5.	$83\overline{)2573}$	$62\overline{)2742}$	$53\overline{)1235}$

6. Tim wanted to find out how much each of 24 pupils should pay to share equally the cost of a \$7.68 map.

This is the way he divided. ⟶

$$\begin{array}{r} \$\ .32 \\ 24\overline{)\$7.68} \\ 72 \\ \hline 48 \\ 48 \\ \hline \end{array}$$

- What is his quotient? Where did Tim write the cents point? the dollar sign?
- Is his answer sensible? Check.

— Estimate the quotient. Then copy, divide, and check. Remember to write the dollar signs and cents points.

	a	*b*	*c*
7.	$15\overline{)\$1.65}$	$22\overline{)\$2.64}$	$31\overline{)\$8.27}$
8.	$42\overline{)\$5.62}$	$14\overline{)\$2.94}$	$21\overline{)\$9.87}$
9.	$94\overline{)\$19.86}$	$93\overline{)\$20.83}$	$62\overline{)\$27.28}$
10.	$52\overline{)\$18.20}$	$72\overline{)\$31.70}$	$93\overline{)\$59.76}$

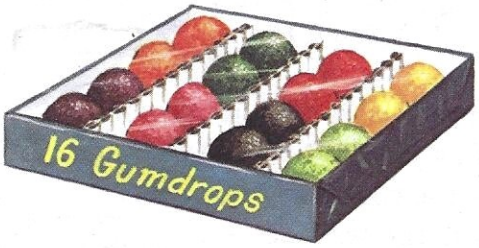
Practice for excellence

Do Practice Set II, page 317.

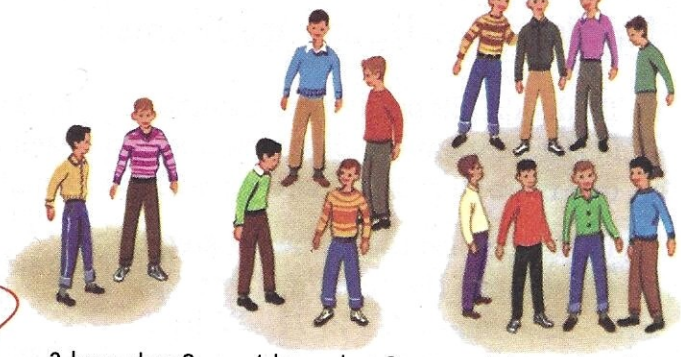
Think twice!

—Can you figure out what number N stands for without using a pencil?

	a	*b*
11.	$N \div 59 = 30\text{r}2$	$402 \div N = 40\text{r}2$
12.	$N \div 40 = 27\text{r}10$	$402 \div N = 20\text{r}2$



How many for each when:



2 boys share? 4 boys share? 8 boys share?

Related divisions

1. Some boys want to share equally the cost of buying a pad of graph paper for 64¢. The cost per boy depends on the number who share.

- If 8 boys share 64¢, the cost to each will be ? .
- If 16 boys share 64¢, the cost to each will be ? .

$$\begin{array}{r} 8¢ \\ 8\overline{)64¢} \end{array} \qquad \begin{array}{r} 4¢ \\ 16\overline{)64¢} \end{array}$$

Do you see how the two divisions above are related? Complete:

If the divisor is doubled without changing the dividend, the new quotient is ? as large as the old.

— Illustrate the statement above by doing these related divisions.

	a		*b*	
2.	$3\overline{)24}$	$6\overline{)24}$	$4\overline{)128}$	$8\overline{)128}$
3.	$5\overline{)60}$	$10\overline{)60}$	$10\overline{)120}$	$20\overline{)120}$

4. How are these divisions related? Make a rule for finding the quotient.

$4\overline{)36}$	$2\overline{)36}$

— Do these related divisions.

	a		*b*	
5.	$8\overline{)72}$	$4\overline{)72}$	$6\overline{)48}$	$3\overline{)48}$
6.	$6\overline{)54}$	$3\overline{)54}$	$10\overline{)140}$	$5\overline{)140}$

7. How are these divisions related? Make a rule for finding the quotient.

$4\overline{)32}$	$4\overline{)64}$

— Do these related divisions.

	a		*b*	
8.	$7\overline{)42}$	$7\overline{)84}$	$9\overline{)63}$	$9\overline{)126}$
9.	$5\overline{)45}$	$5\overline{)90}$	$40\overline{)80}$	$40\overline{)160}$

— In Exs. 10 to 12, work the easier example first, then use it to find the quotient to the other division.

10.	$8\overline{)80}$	$8\overline{)160}$	$7\overline{)56}$	$7\overline{)112}$
11.	$16\overline{)48}$	$8\overline{)48}$	$30\overline{)90}$	$15\overline{)90}$
12.	$70\overline{)140}$	$35\overline{)140}$	$10\overline{)150}$	$5\overline{)150}$

Getting ready for division tests

— Copy and divide. Check your work.

	a	*b*	*c*	*d*	*e*	*f*
1.	$6\overline{)53}$	$8\overline{)896}$	$6\overline{)\$5.45}$	$7\overline{)4928}$	$8\overline{)7593}$	$7\overline{)\$70.42}$
2.	$60 \div 9$	$98 \div 7$	$\$6.94 \div 8$	$5427 \div 7$	$5640 \div 9$	$\$61.88 \div 7$
3.	$34\overline{)68}$	$81\overline{)668}$	$53\overline{)\$1.49}$	$42\overline{)969}$	$11\overline{)894}$	$33\overline{)\$4.29}$
4.	$269 \div 73$	$445 \div 55$	$\$3.87 \div 43$	$966 \div 42$	$2263 \div 73$	$\$890 \div 42$

Division tests

— Copy, divide, and check. Try to get a perfect score on each test.

TEST I

1. $8\overline{)75}$	2. $9\overline{)\$5.85}$	3. $8\overline{)5384}$	4. $5\overline{)4798}$	5. $9\overline{)\$63.73}$
6. $78 \div 8$	7. $\$5.09 \div 6$	8. $5\overline{)\$15.65}$	9. $7\overline{)2830}$	10. $9\overline{)\$19.48}$

Practice for excellence. Do Practice Set I, page 317.

TEST II

1. $13\overline{)39}$	2. $41\overline{)205}$	3. $99\overline{)\$5.94}$	4. $66\overline{)3432}$	5. $51\overline{)\$11.73}$
6. $99 \div 32$	7. $345 \div 23$	8. $\$7.88 \div 32$	9. $1596 \div 21$	10. $\$45.39 \div 31$

Practice for excellence. Do Practice Set II, page 317.

Think twice!

— Use this multiplication → $\boxed{38 \times 64 = 2432}$ to find the answers for the division examples given below. Do not use a pencil.

a	*b*	*c*	*d*
$2432 \div 38$	$2432 \div 32$	$2432 \div 128$	$2432 \div 76$
$2432 \div 64$	$2432 \div 16$	$2432 \div 19$	$2432 \div 8$

PROBLEM TEST 1

1. A football team scored a total of 144 points in 9 games. What was the average number of points per game?

2. Lester has \$11.23. If he pays \$6.98 for a plaid flannel shirt, how much will he have left?

3. Marie had 82¢ in her purse. When she looked later, she had only 32¢. She said, "I've lost a ? dollar."

4. Dan's father gives him an allowance of \$.45 a week. How much does that amount to in a year?

5. Fred bought a magnet for 69¢, a flashlight bulb for 36¢, and 3 flashlight batteries at 12¢ each. How much did he spend?

6. Twenty-two boys camped out for a week end. A truck hauled 946 lb. of equipment and supplies for them. What was the average weight of equipment per camper?

7. Penny paid \$21.15 for 9 dancing lessons. Find the cost per lesson.

8. Diana and her two friends are selling special potting soil for African violets. In one week they sold 7 two-pound packages and 3 five-pound packages. How many pounds of soil did they sell that week?

9. The girls' expenses (Ex. 8) amounted to \$3.05, and their total receipts from the sale of the potting soil amounted to \$6.50. If the girls shared the profits equally, what was each girl's share?

10. Boyd weighs 96 lb. and his younger brother weighs 67 lb. The boys' father weighs 182 lb. The father's weight is ? lb. more than the combined weight of the boys.

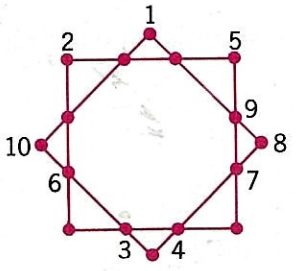
There are seven tests like this one in your book. Start a *Problem Test Record.* Write on it the score you make on this test. Each time you take a Problem Test, write your score on your *Problem Test Record.*

JUST FOR FUN

Copy this drawing. Place the numbers 1 to 16 beside the dots in such a way that:

- the sum of the numbers on the corners of each square equals 34.
- the sum of the numbers on each side equals 34.

The numbers 1 to 10 are placed for you.



IT'S CHECK-UP TIME

This test will help you measure what you have learned in Chapter 2. Work carefully. Check your answers. Be sure that every answer is sensible.

16	34	44	16	3)16
− 3	× 16	− 16	+ 34	

1. Copy the example in the box above in which 16 is used as a dividend; an addend; a minuend; a subtrahend; a factor.

2. Write each addend in this example rounded to the nearest thousand and find the estimated sum.

5672
846
6523
3040
479

— Write the missing numbers.

3. $12 \times 35 = (2 \times 35) + (\underline{?} \times 35)$

4. $12 \times 25 = (4 \times 25) \times \underline{?}$

5. $32 \times 27 = 864$, so $864 \div 27 = \underline{?}$

6. Find the sum of: \$46.35, \$9.08, \$74.39, \$60.20, and \$7.59.

7. $\begin{array}{r} 50762 \\ -\ 943 \\ \hline \end{array}$

8. $\begin{array}{r} \$390.00 \\ -\ 88.76 \\ \hline \end{array}$

9. $\begin{array}{r} 657 \\ \times\ 48 \\ \hline \end{array}$

10. 985×507

11. 9 yd. = ? in.

12. $3078 \div 9$

13. $115 \div 23$

14. $105 \div 34$

15. $\$36.49 \div 41$

16. If $N + 70 = 156$, $N = \underline{?}$.

17. Find the product of 269 and 59.

18. Find the quotient of $900 \div 42$.

19. 38 and 27 are factors of ?.

20. Lois spent \$3.76 for lunches in 8 days, an average of ? per day.

If you have time, try these —

21. If the divisor is 74 and the quotient is 87 r49, the dividend is ?.

22. $(72 \div 3) + (72 \div 3) = \underline{?} \div 3$

TRY IT!

Here is a short cut to try.
To discover the sum of several addends in a counting series:

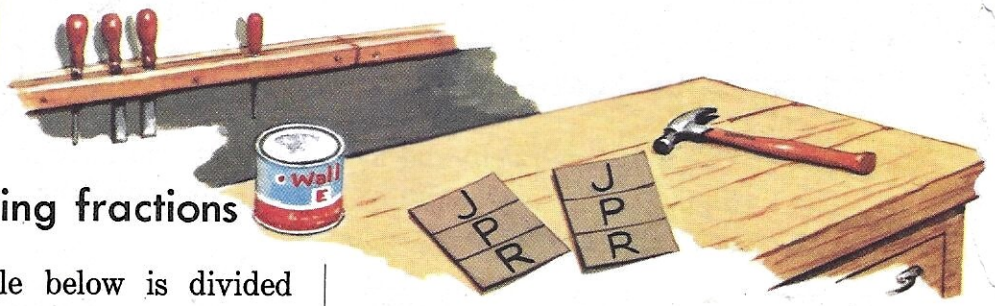
- ▶ Add the smallest and largest addends. $1 + 8 = \boxed{9}$
- ▶ Find $\frac{1}{2}$ the number of addends. $\frac{1}{2}$ of $8 = \boxed{4}$
- ▶ Multiply the two results. $\boxed{4} \times \boxed{9} = 36$

1
2
3
4
5
6
7
+ 8

— Use the short cut to discover these sums. Check by adding.

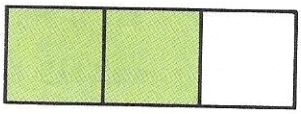
1. $2 + 4 + 6 + 8 + 10$
2. $5 + 10 + 15 + 20$
3. $6 + 9 + 12 + 15 + 18$

CHAPTER 3



Understanding fractions

1. The rectangle below is divided into ? equal parts. How many parts are colored? not colored?

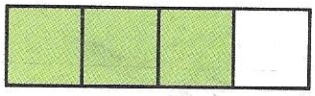


In the fraction $\frac{2}{3}$, the 3 is the ***denominator***. It tells the number of equal parts into which a whole has been divided.

In the fraction $\frac{2}{3}$, the 2 is the ***numerator***. It tells the number of equal parts about which we are thinking.

— In Exs. 2 and 3 which numbers are the denominators? the numerators? What do the denominators show? the numerators?

2. $\frac{3}{4}$ $\frac{1}{4}$ $\frac{4}{4}$



3. $\frac{5}{8}$ $\frac{3}{8}$ $\frac{8}{8}$

4. Read each of these fractions.

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{2}{3}$ $\frac{1}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ $\frac{1}{8}$ $\frac{3}{8}$

5. The fractions in Ex. 4 may be read: "1 divided by 2," "1 divided by 3," etc. Read the other fractions in this way.

6. Write as fractions: $2 \div 5$; $5 \div 6$.

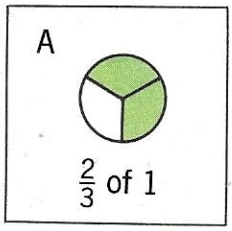
7. Jack, Pete, and Roy divided 2 sheets of sandpaper equally among themselves. The J's show that Jack took $\frac{1}{3}$ of the first sheet and $\frac{1}{3}$ of the second sheet. In all, he took ? thirds of a sheet. $2 \div 3 = ?$.

- How much sandpaper did Pete get? Roy?
- Each of the 3 equal parts into which 2 sheets were divided is $\frac{2}{3}$ of a sheet. Does $\frac{1}{3}$ of $2 = \frac{2}{3}$ of 1?

8. Four boys divided 3 pies equally. Which of these statements are true?

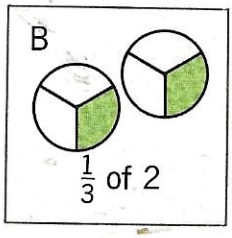
- Each boy got $\frac{1}{4}$ of 3.
- Each boy got $\frac{3}{4}$ of 1.
- $3 \div 4 = \frac{3}{4}$.
- $\frac{3}{4}$ is $\frac{1}{4}$ of 3.
- $\frac{1}{4}$ is $\frac{1}{3}$ of $\frac{3}{4}$.
- The fraction $\frac{3}{4}$ is a number smaller than 1.

9. In diagram A the $\frac{2}{3}$ means "2 of the ? equal parts of 1." →



In diagram B $\frac{2}{3}$ means "$\frac{1}{3}$ of 2." →

The fraction $\frac{2}{3}$ means: $\frac{1}{3}$ of 2 or $\frac{2}{3}$ of 1.

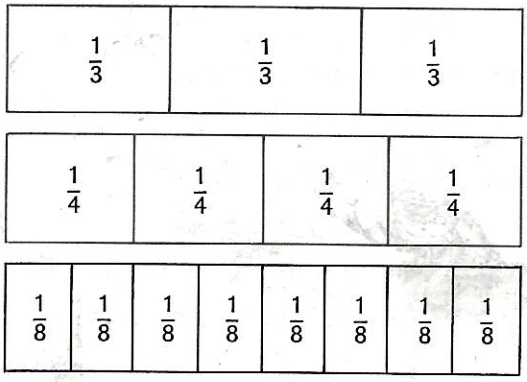


The meaning of fractions

1. Which is most? least?

$\frac{1}{2}$ inch $\frac{1}{4}$ inch $\frac{1}{8}$ inch

2. The bars show that $\frac{1}{3}$ is greater than $\frac{1}{4}$; that $\frac{1}{4}$ is $\underline{?}$ than $\frac{1}{8}$.



The bars show that the more equal parts you divide something into, the $\underline{?}$ each part will be.

3. Which fraction has the greatest value? the least?

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{10}$

4. Fractions such as $\frac{1}{5}$, $\frac{5}{8}$, $\frac{7}{10}$ are called ***proper fractions.***

What do you discover when you compare the numerator with the denominator of each of the above fractions?

In every *proper fraction* the numerator is smaller than the denominator.

The numerator and denominator are called the ***terms*** of the fraction.

5. Fractions such as $\frac{7}{3}$, $\frac{6}{6}$, $\frac{10}{4}$ are called ***improper fractions.***

What do you discover when you compare the numerator with the denominator of each fraction above?

In an *improper fraction* the numerator is equal to or larger than the denominator.

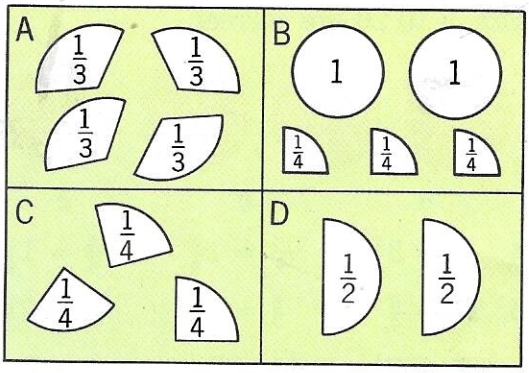
6. The following numbers are called ***whole numbers.*** Can you tell why?

5 23 500 2465

7. The following numbers are called ***mixed numbers.*** Can you tell why?

$1\frac{2}{3}$ $3\frac{5}{6}$ $2\frac{1}{2}$ $4\frac{3}{8}$ $5\frac{4}{5}$

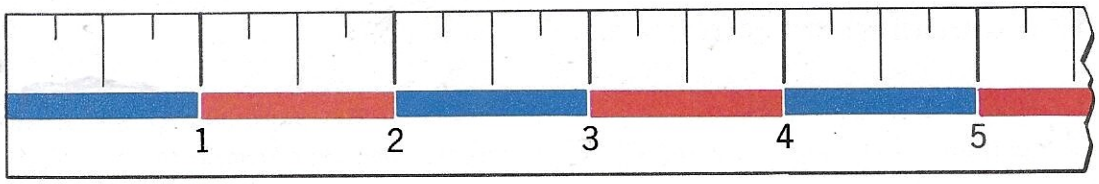
8. In which box do the pieces together show a proper fraction? a mixed number? an improper fraction? a whole number? Explain.



9. Name the numerator and the denominator of each.

$\frac{7}{8}$ $\frac{9}{3}$ $\frac{5}{6}$ $\frac{2}{5}$ $\frac{15}{10}$

10. Which fractions in Ex. 9 are proper fractions? improper fractions?



Working with ruler fractions

1. Using a ruler, count by $\frac{1}{2}$ inches from $\frac{1}{2}$ inch to $4\frac{1}{2}$ inches. Count backward by half inches from 4 to 1.

2. Use your ruler to show that both of these ways of counting by $\frac{1}{4}$ inches are correct.

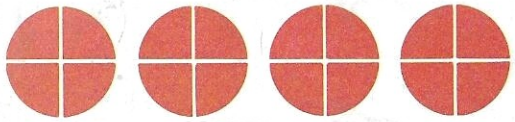
- $\frac{1}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ $\frac{5}{4}$ $\frac{6}{4}$ $\frac{7}{4}$ $\frac{8}{4}$
- $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$ 1 $1\frac{1}{4}$ $1\frac{1}{2}$ $1\frac{3}{4}$ 2

3. The counting in Ex. 2 shows:

$\frac{2}{4} = \frac{?}{2}$ $\frac{4}{4} = \frac{?}{1}$ $\frac{5}{4} = \frac{?}{1}$

$\frac{6}{4} = \frac{?}{1}$ $\frac{7}{4} = \frac{?}{1}$ $\frac{8}{4} = \frac{?}{1}$

— Use the ruler or the diagram below to show that the statements in Exs. 4 to 20 are correct.



a *b* *c*

4. $\frac{15}{4} = 3\frac{3}{4}$ $\frac{11}{4} = 2\frac{3}{4}$ $\frac{5}{4} = 1\frac{1}{4}$

5. $1\frac{1}{2} = \frac{6}{4}$ $\frac{6}{2} = 3$ $\frac{10}{4} = 2\frac{1}{2}$

6. $\frac{7}{2} = 3\frac{1}{2}$ $\frac{12}{4} = 3$ $\frac{8}{4} = 2$

7. The mixed number $3\frac{3}{4}$ is equal to the improper fraction $\frac{15}{4}$.

8. $\frac{9}{4}$ is equal to $2\frac{1}{4}$.

9. $\frac{4}{4} + \frac{4}{4} + \frac{4}{4} + \frac{3}{4} = \frac{15}{4}$.

10. The difference between 3 and $1\frac{3}{4}$ is $1\frac{1}{4}$.

11. In $2\frac{1}{2}$ there are five $\frac{1}{2}$'s; so $2\frac{1}{2} \div \frac{1}{2} = 5$.

12. In 3 there are twelve $\frac{1}{4}$'s; so $3 \div \frac{1}{4} = 12$.

13. $\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{12}{4}$, or 3.

14. In 3 there are four $\frac{3}{4}$'s; so $3 \div \frac{3}{4} = 4$.

15. 4 times $\frac{3}{4}$ equals 3.

16. The sum of $2\frac{1}{2}$ and $\frac{3}{4}$ is $3\frac{1}{4}$.

17. 6 times $\frac{1}{2}$ equals 3.

18. In 2 there are four $\frac{1}{2}$'s; so $2 \div \frac{1}{2} = 4$.

19. 2 times $1\frac{1}{2}$ equals 3.

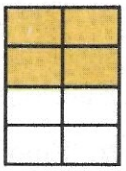
20. In 3 there are two $1\frac{1}{2}$'s; so $3 \div 1\frac{1}{2} = 2$.

— Which statements below do you believe to be true? false? Use the ruler to prove your answers.

	a	*b*
21.	$3\frac{3}{4} - \frac{5}{4} = 2$	$2\frac{3}{4} - \frac{1}{2} = 2\frac{1}{4}$
22.	$2 - \frac{3}{4} = 1\frac{1}{4}$	$5 - \frac{3}{4} = 4\frac{1}{4}$
23.	$2\frac{1}{2} + \frac{1}{4} = 2\frac{3}{4}$	$1\frac{1}{2} + 1\frac{3}{4} = 3\frac{1}{4}$

Equivalent fractions

1. The rectangle shown is divided into 8 equal parts. What does it show about $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{4}{8}$?



Fractions which represent the same amount (or number) are called ***equivalent fractions.***

2. If you multiply both terms of $\frac{1}{2}$ by 4, you get: $\frac{1 \times 4}{2 \times 4}$, or $\frac{4}{8}$.

Does $\frac{1}{2} = \frac{4}{8}$?

If you ***multiply*** both terms of any fraction by the same number, you get an *equivalent fraction* expressed in ***higher terms.***

3. Write six fractions equivalent to $\frac{1}{2}$.

4. If you divide both terms of $\frac{4}{8}$ by 4, you get: $\frac{4 \div 4}{8 \div 4}$, or $\frac{1}{2}$.

$\frac{4}{8}$ and $\frac{1}{2}$ are $\frac{?}{}$ fractions.

If you ***divide*** both terms of a fraction by the same number, you get an equivalent fraction expressed in ***lower terms.***

5. Is 2 a factor of both terms of the fraction $\frac{48}{64}$? Then 2 is called a ***common factor*** of 48 and 64.

Is 3 a common factor of both terms of $\frac{48}{64}$? is 4? 8? 16?

What is the ***largest common*** factor of both terms of the fraction $\frac{48}{64}$?

If you divide both terms of any fraction by the *largest common factor* you get an equivalent fraction in ***lowest terms.***

6. Write four fractions equivalent to $\frac{48}{64}$, and in lower terms.

7. When you express $\frac{48}{64}$ as $\frac{3}{4}$, you are expressing $\frac{48}{64}$ in *lowest terms.*

Expressed in lowest terms, $\frac{24}{36}$ is $\frac{?}{?}$.

Expressing a fraction in lowest terms is often called ***changing a fraction to lowest terms.***

— Express in lowest terms.

	a	*b*	*c*	*d*
8.	$\frac{12}{24}$	$\frac{8}{24}$	$\frac{12}{16}$	$\frac{12}{15}$
9.	$\frac{18}{27}$	$\frac{24}{30}$	$\frac{12}{20}$	$\frac{8}{10}$
10.	$\frac{6}{8}$	$\frac{4}{10}$	$\frac{15}{20}$	$\frac{24}{32}$
11.	$\frac{44}{144}$	$\frac{50}{100}$	$\frac{6}{18}$	$\frac{10}{25}$

12. The improper fraction $\frac{24}{16}$ may be expressed as $\frac{12}{?}$, or $\frac{?}{4}$, or $\frac{3}{?}$, or $1\frac{1}{2}$.

When you express $\frac{24}{16}$ as $1\frac{1}{2}$, you are expressing $\frac{24}{16}$ in ***simplest form.***

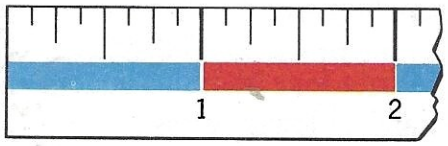
— Express in simplest form.

13.	$\frac{6}{4}$	$\frac{12}{9}$	$8\frac{8}{6}$	$6\frac{4}{6}$
14.	$2\frac{8}{8}$	$\frac{14}{21}$	$4\frac{6}{6}$	$5\frac{6}{4}$

15. Make a drawing to show that $1\frac{2}{3}$ and $\frac{5}{3}$ are equivalent.

Adding and subtracting like fractions

1. Bruce says this ruler shows halves, fourths, and eighths at the same time. How can he tell?



2. On the ruler find these fractions.

$\frac{1}{4}$ $\frac{3}{4}$ $\frac{5}{4}$ $\frac{7}{4}$

The fractions above are fourths; their denominators are *alike*.

Fractions with denominators that are alike are called ***like fractions***.

Like fractions are said to have a ***common denominator***.

3. Find three more fractions on the ruler that are fourths.

4. On the ruler find $\frac{1}{2}$; $\frac{2}{2}$; $\frac{4}{2}$; $\frac{3}{2}$. Do these fractions have a common denominator? Are they *like fractions?*

5. Find five like fractions on the ruler with a common denominator of 8.

6. From the following, list the fractions that are *like* fractions; that are not *like* fractions.

$\frac{1}{10}$ $\frac{2}{3}$ $\frac{1}{6}$ $\frac{3}{10}$ $\frac{4}{7}$

Fractions whose denominators are not alike are called ***unlike fractions***.

7. Give examples of unlike fractions on the ruler.

8. Gail says the ruler shows that some unlike fractions are equivalent fractions. Explain. $\frac{1}{2} = \frac{2}{4} = \frac{4}{?}$

9. Find an unlike fraction equivalent to each of the following.

$\frac{1}{2}$ $\frac{3}{4}$ $\frac{12}{8}$ $\frac{2}{2}$ $\frac{3}{2}$

10. You can add 5 tenths and 3 tenths. The sum is $\frac{?}{}$ tenths.

11. Which of these three ways of adding fractions do you prefer?

a $\begin{array}{r} 5 \text{ tenths} \\ +\ 3 \text{ tenths} \\ \hline 8 \text{ tenths} \end{array}$	*b* $\begin{array}{r} \frac{5}{10} \\ +\ \frac{3}{10} \\ \hline \frac{8}{10} \end{array}$
c $\frac{5}{10} + \frac{3}{10} = \frac{5+3}{10} = \frac{8}{10}$	

12. Make a rule for adding like fractions.

13. Which of these three ways of subtracting fractions do you prefer?

a $\begin{array}{r} 5 \text{ tenths} \\ -\ 3 \text{ tenths} \\ \hline 2 \text{ tenths} \end{array}$	*b* $\begin{array}{r} \frac{5}{10} \\ -\ \frac{3}{10} \\ \hline \frac{2}{10} \end{array}$
c $\frac{5}{10} - \frac{3}{10} = \frac{5-3}{10} = \frac{2}{10}$	

14. Make a rule for subtracting like fractions.

15. $\frac{7}{8} - \frac{5}{8} = \frac{?}{8} = \frac{?}{4}$

16. $\frac{5}{6} - \frac{3}{6} = \frac{?}{6} = \frac{?}{3}$

17. $\frac{9}{10} - \frac{3}{10} = \frac{?}{10} = \frac{?}{5}$

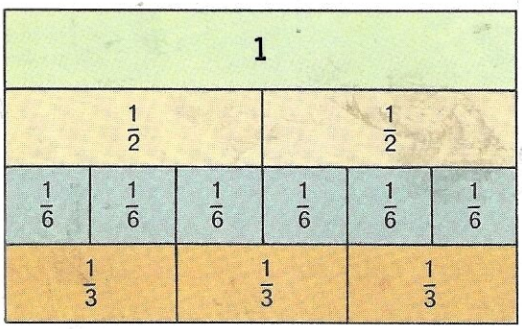
Adding and subtracting unlike fractions

1. To add $\frac{1}{2}$ and $\frac{1}{3}$, Joyce wrote: ⟶ She could not go on. Why not?

1 half
+ 1 third

$\frac{1}{2}$ and $\frac{1}{3}$ are *unlike* fractions. They do not have a common denominator.

2. Use the diagram below to find the sum of $\frac{1}{2}$ and $\frac{1}{3}$.



The diagram shows:

$$\frac{1}{2} = \frac{?}{6} \qquad \frac{1}{3} = \frac{?}{6}$$

$$\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{?}{6}$$

Unlike fractions, such as $\frac{1}{2}$ and $\frac{1}{3}$, must be expressed as like fractions before they can be added or subtracted.

3. Explain and complete the addition at the right. ⟶

$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ +\,\frac{1}{3} = \frac{?}{6} \\ \hline \frac{?}{6} \end{array}$$

4. Can you subtract $\frac{1}{3}$ from $\frac{1}{2}$ this way? →

1 half
− 1 third

5. The diagram shows that $\frac{1}{2} = \frac{?}{6}$; $\frac{1}{3} = \frac{?}{6}$. Show that $\frac{1}{2} - \frac{1}{3} = \frac{?}{6}$.

6. Before you can subtract $\frac{1}{3}$ from $\frac{1}{2}$, you must find a common denominator for the fractions.

Explain and complete this subtraction. ⟶

$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ -\,\frac{1}{3} = \frac{2}{6} \\ \hline \frac{?}{6} \end{array}$$

— Draw diagrams to help explain these examples. Tell the answers.

7.

a	*b*	*c*
$\frac{1}{5} = \frac{2}{10}$	$\frac{3}{8} = \frac{3}{8}$	$\frac{1}{4} = \frac{3}{12}$
$+\,\frac{1}{10} = \frac{1}{10}$	$+\,\frac{1}{4} = \frac{2}{8}$	$+\,\frac{2}{3} = \frac{8}{12}$
$\frac{?}{10}$	$\frac{?}{8}$	$\frac{?}{12}$

8. How would you find the missing numerator in $\frac{4}{5} = \frac{?}{10}$? Explain this way of doing it: $\frac{4}{5} = \frac{4 \times 2}{5 \times 2} = \frac{8}{10}$.

— Find the missing numerators.

	a	*b*	*c*	*d*
9.	$\frac{2}{5} = \frac{?}{10}$	$\frac{2}{3} = \frac{?}{6}$	$\frac{3}{4} = \frac{?}{12}$	$\frac{1}{2} = \frac{?}{10}$
10.	$\frac{2}{3} = \frac{?}{12}$	$\frac{3}{4} = \frac{?}{8}$	$\frac{3}{5} = \frac{?}{10}$	$\frac{1}{6} = \frac{?}{12}$

— Copy, then add or subtract.

	a	*b*	*c*	*d*
11.	$\frac{1}{2} + \frac{3}{4}$	$\frac{2}{3} + \frac{1}{6}$	$\frac{3}{8} + \frac{1}{2}$	$\frac{7}{10} + \frac{1}{5}$
12.	$\frac{3}{4} - \frac{1}{2}$	$\frac{5}{6} - \frac{1}{3}$	$\frac{1}{2} - \frac{3}{8}$	$\frac{5}{8} - \frac{1}{4}$
13.	$\frac{3}{5} + \frac{1}{2}$	$\frac{1}{4} + \frac{1}{3}$	$\frac{2}{3} + \frac{1}{2}$	$\frac{3}{4} + \frac{2}{3}$

Smallest common denominator

1. When Bill added $\frac{1}{2}$ and $\frac{1}{4}$, he thought, "$\frac{4}{8} + \frac{2}{8} = \frac{6}{8}$, or $\frac{3}{4}$."

When Agnes did the addition, she thought, "$\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$."

What common denominator did Bill use? Agnes?

The ***smallest common denominator*** of $\frac{1}{2}$ and $\frac{1}{4}$ is ___?___.

2. Find the smallest common denominator of:

$\frac{1}{2}, \frac{3}{4}, \frac{5}{8}$ $\frac{1}{2}, \frac{3}{5}, \frac{7}{10}$ $\frac{2}{3}, \frac{1}{2}, \frac{5}{12}$

Here is a good way to find the smallest common denominator of several fractions:

▶ Look to discover whether the largest denominator is the common denominator.

▶ If it is not, try 2 times the largest denominator.

▶ If 2 times will not do, try 3 times the largest denominator; and so on.

3. First tell the smallest common denominator in each example below. Then work the example.

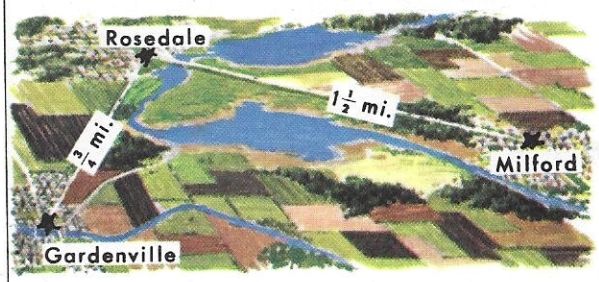
$\frac{1}{2} + \frac{1}{3}$ $\frac{1}{3} + \frac{1}{12}$ $\frac{1}{4} + \frac{1}{6}$ $\frac{1}{3} + \frac{1}{4}$

4. Which of the numbers 3, 6, 9, 12, and 15 are common denominators of the fractions $\frac{1}{2}$ and $\frac{1}{3}$? Which is the smallest common denominator?

5. Find the smallest common denominator of each of these groups of fractions:

$\frac{5}{6}, \frac{1}{4}$ $\frac{1}{2}, \frac{2}{3}, \frac{1}{4}$ $\frac{3}{4}, \frac{1}{2}, \frac{5}{6}$ $\frac{3}{5}, \frac{3}{4}$

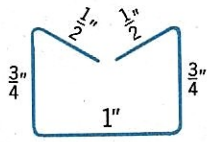
6. How far is it by road from Milford to Gardenville?



7. Sara is making a costume. The pattern calls for $\frac{2}{3}$ yd. of fringe for the apron and $\frac{3}{4}$ yd. for the cape. How much fringe does Sara need all together?

8. The clerk will not sell Sara $1\frac{5}{12}$ yd. of fringe, but will sell her $1\frac{1}{4}$ yd., $1\frac{1}{2}$ yd., or $1\frac{3}{4}$ yd. Which of these should Sara take? Explain why.

9. How long a piece of wire would you need to make this?→



10. The distance between Newtown and Cliff Park is $2\frac{7}{10}$ mi. How long a hike will a scout troop have, hiking from Newtown to the park and back?

Practice for excellence

Do Practice Set I, page 320.

Oral practice

— Explain how Exs. 1 to 4 are done.

1. $\begin{array}{r} \frac{3}{5} \\ +\frac{4}{5} \\ \hline \end{array}$ $\quad \frac{7}{5} = 1\frac{2}{5}$

2. $\begin{array}{r} \frac{3}{8} \\ +\frac{7}{8} \\ \hline \end{array}$ $\quad \frac{10}{8} = 1\frac{2}{8} = 1\frac{1}{4}$

3. $\begin{array}{r} 1\frac{3}{4} = 1\frac{9}{12} \\ +2\frac{5}{6} = 2\frac{10}{12} \\ \hline \end{array}$ $\quad 3\frac{19}{12} = 3 + 1\frac{7}{12} = 4\frac{7}{12}$

4. $\begin{array}{r} \frac{2}{5} = \frac{4}{10} \\ 1\frac{1}{2} = 1\frac{5}{10} \\ +\frac{3}{5} = \frac{6}{10} \\ \hline \end{array}$ $\quad 1\frac{15}{10} = 1 + 1\frac{5}{10} = 2\frac{5}{10} = 2\frac{1}{2}$

— Explain how to solve the following problems. Tell the answers.

5. Roland's mother bought 2 frying chickens. One weighed $3\frac{3}{8}$ lb. and the other weighed $2\frac{1}{2}$ lb. How many pounds of chicken did she buy all together?

6. Mabel is buying material for a skirt and blouse. She needs $2\frac{3}{4}$ yd. for the skirt and $1\frac{5}{8}$ yd. for the blouse. How much material does she need?

7. One box of candy weighs $\frac{15}{16}$ lb. Another weighs $\frac{3}{4}$ lb. How much do they weigh together?

Written practice in addition

— Copy and add.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{6}$	$1\frac{3}{4}$	$2\frac{1}{6}$	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{7}{10}$
	$\frac{2}{8}$	$\frac{1}{3}$	$\frac{7}{12}$	$\frac{1}{8}$	$5\frac{1}{3}$	$\frac{1}{3}$	$1\frac{1}{6}$	$\frac{2}{5}$
2.	$\frac{9}{10}$	$\frac{7}{8}$	$\frac{7}{10}$	$\frac{1}{4}$	$\frac{1}{12}$	$2\frac{5}{6}$	$\frac{3}{4}$	$2\frac{7}{8}$
	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{7}{10}$	$\frac{2}{3}$	$\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{7}{16}$	$5\frac{3}{4}$
3.	$\frac{1}{2}$	$5\frac{3}{5}$	$2\frac{5}{12}$	$\frac{7}{8}$	$\frac{7}{12}$	$1\frac{1}{2}$	$4\frac{3}{8}$	$2\frac{5}{12}$
	$\frac{1}{4}$	$2\frac{1}{10}$	$6\frac{3}{4}$	$9\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$3\frac{1}{2}$	$6\frac{5}{6}$
	$\frac{1}{8}$	3	4	$5\frac{1}{4}$	$\frac{2}{3}$	$2\frac{5}{6}$	$5\frac{5}{16}$	8
4.	$\frac{1}{3}$	4	$\frac{7}{8}$	$\frac{9}{10}$	$\frac{5}{6}$	$2\frac{7}{10}$	$3\frac{1}{2}$	$\frac{7}{10}$
	$\frac{1}{2}$	$3\frac{5}{8}$	5	$2\frac{3}{10}$	$\frac{5}{12}$	$3\frac{1}{10}$	$2\frac{3}{4}$	$\frac{1}{2}$
	$\frac{1}{6}$	$2\frac{3}{4}$	$4\frac{1}{2}$	4	$\frac{1}{3}$	$4\frac{1}{5}$	$\frac{1}{3}$	$5\frac{1}{5}$

Practice for excellence. Do Practice Set II, page 320.

A test in adding fractions

— Try to get a perfect score on this test. Copy the examples. Credit will be given only for answers expressed in simplest form.

1. $\frac{1}{12} + \frac{1}{12}$

2. $\frac{1}{10} + \frac{7}{10} + \frac{9}{10}$

3. $\frac{2}{3} + \frac{7}{12}$

4. $\frac{3}{8} + \frac{1}{4} + \frac{5}{16}$

5. $\begin{array}{r} \frac{5}{6} \\ +\ \frac{5}{12} \\ \hline \end{array}$

6. $\begin{array}{r} 2\frac{2}{3} \\ +\ \frac{5}{6} \\ \hline \end{array}$

7. $\begin{array}{r} 10\frac{3}{4} \\ \frac{7}{8} \\ +\ 1\frac{1}{2} \\ \hline \end{array}$

8. $\frac{4}{5} + \frac{1}{2}$

9. $1\frac{1}{2} + 1\frac{1}{3}$

10. $\frac{1}{6} + \frac{2}{3} + \frac{1}{4}$

11. $\frac{1}{2} + \frac{2}{5} + \frac{1}{4}$

12. $5\frac{3}{4} + \frac{1}{6}$

13. $10\frac{9}{10} + 5\frac{3}{5}$

14. $2\frac{5}{8} + 1\frac{3}{4}$

15. $\begin{array}{r} \frac{7}{12} \\ 5\frac{1}{4} \\ +\ 8\frac{1}{6} \\ \hline \end{array}$

16. $\begin{array}{r} 8\frac{7}{16} \\ +\ 2\frac{9}{16} \\ \hline \end{array}$

17. $\begin{array}{r} 5\frac{1}{2} \\ 9\frac{4}{5} \\ +\ 6\frac{7}{10} \\ \hline \end{array}$

18. $\begin{array}{r} 5\frac{1}{2} \\ +\ 2\frac{2}{5} \\ \hline \end{array}$

19. $\begin{array}{r} 20\frac{2}{9} \\ +\ 12\frac{2}{3} \\ \hline \end{array}$

20. $\begin{array}{r} 6\frac{1}{4} \\ 6\frac{2}{5} \\ +\ \frac{7}{10} \\ \hline \end{array}$

Using fractions

To test the strength of his fishing line, Mike keeps putting small stones in a pail on the scale until the line breaks.

1. How much pull (weight) is there on the line now being tested?

2. The line took $4\frac{1}{8}$ lb. more weight without breaking. What was the amount of pull then?

3. Mike is testing two lines both of which are sold as "9-pound test" lines. What does that mean?

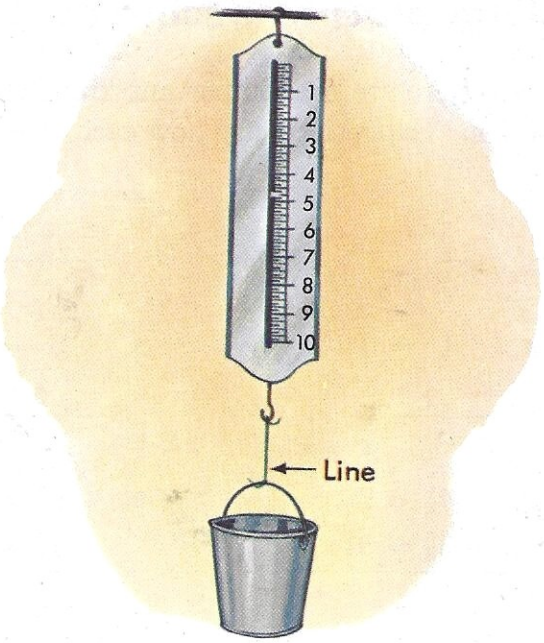
4. Mike tested five samples of Line A and five samples of Line B. The maximum weight for each test is shown below.

	Line A	Line B
Test #1	$9\frac{1}{4}$ lb.	9 lb.
Test #2	$8\frac{3}{4}$ lb.	$9\frac{1}{4}$ lb.
Test #3	$8\frac{1}{2}$ lb.	$8\frac{3}{4}$ lb.
Test #4	$9\frac{1}{4}$ lb.	9 lb.
Test #5	9 lb.	$9\frac{1}{4}$ lb.

5. Find the total weight for the five tests of Line A; of Line B.

6. Which line took more weight? how much more? Why do you think Mike wanted more than one test for each line?

7. On the basis of this test, which line do you think Mike is likely to recommend? Why do you think so?



8. Mike caught two fish on his last trip. One weighed $2\frac{7}{8}$ lb. and the other weighed $3\frac{1}{2}$ lb. How much less did the first fish weigh than the second?

9. What was the combined weight of the two fish in Ex. 8?

10. Mike's brother caught one fish. It weighed $1\frac{3}{4}$ lb. How much heavier was Mike's larger fish than his brother's?

11. Mike's catch and his brother's catch together weighed ? lb.

12. On the next fishing trip each boy plans to carry a 7-pound pack. Mike plans to take a blanket weighing $3\frac{3}{4}$ lb., and a camp ax weighing $2\frac{2}{3}$ lb.

How much more weight can he take to complete his pack?

Oral practice in subtraction

— Here are nine important kinds of examples in subtracting fractions. Explain exactly how each example is worked.

1. $\frac{7}{8}$
$-\frac{3}{8}$
$\frac{4}{8} = \frac{1}{2}$

2. $\frac{7}{10} = \frac{7}{10}$
$-\frac{2}{5} = \frac{4}{10}$
$\frac{3}{10}$

3. $5\frac{1}{4} = 5\frac{3}{12}$
$-4\frac{1}{6} = 4\frac{2}{12}$
$1\frac{1}{12}$

4. $1 = \frac{4}{4}$
$-\frac{1}{4} = \frac{1}{4}$
$\frac{3}{4}$

5. $5 = 4\frac{3}{3}$
$-\frac{2}{3} = \frac{2}{3}$
$4\frac{1}{3}$

6. $4 = 3\frac{3}{3}$
$-1\frac{2}{3} = 1\frac{2}{3}$
$2\frac{1}{3}$

7. $4\frac{1}{6} = 3\frac{7}{6}$
$-3\frac{5}{6} = 3\frac{5}{6}$
$\frac{2}{6} = \frac{1}{3}$

8. $5\frac{1}{8} = 4\frac{9}{8}$
$-1\frac{7}{8} = 1\frac{7}{8}$
$3\frac{2}{8} = 3\frac{1}{4}$

9. $4\frac{1}{4} = 4\frac{3}{12} = 3\frac{15}{12}$
$-2\frac{1}{3} = 2\frac{4}{12} = 2\frac{4}{12}$
$1\frac{11}{12}$

Written practice in subtraction

— Copy and subtract.

	a	*b*	*c*	*d*	*e*	*f*
1.	$2\frac{1}{2}$ $-\frac{3}{5}$	$3\frac{1}{3}$ $-\frac{5}{6}$	$4\frac{1}{4}$ $-1\frac{7}{12}$	$5\frac{1}{3}$ $-1\frac{3}{4}$	$4\frac{1}{2}$ $-\frac{7}{8}$	$5\frac{1}{6}$ $-2\frac{2}{3}$
2.	$\frac{7}{12}$ $-\frac{5}{12}$	$\frac{9}{10}$ $-\frac{3}{5}$	$4\frac{1}{2}$ $-1\frac{1}{3}$	$5\frac{7}{8}$ $-2\frac{3}{8}$	$5\frac{1}{10}$ $-2\frac{1}{2}$	$6\frac{3}{8}$ -5
3.	$\frac{9}{16}$ $-\frac{3}{16}$	$\frac{7}{12}$ $-\frac{1}{3}$	$5\frac{3}{4}$ $-4\frac{1}{3}$	$6\frac{5}{6}$ $-4\frac{1}{3}$	$8\frac{7}{8}$ $-\frac{1}{4}$	$9\frac{3}{10}$ $-4\frac{4}{5}$

4. Alice has 10 yd. of ribbon. If she uses $1\frac{3}{4}$ yd. to tie a gift package, how much will be left?

5. Joan has $2\frac{1}{2}$ lb. of butter. If she uses $\frac{3}{4}$ lb. for a cake, how much will she have left?

6. Peter had a pint (2 cups) of molasses. He used $\frac{3}{4}$ cup in making popcorn balls. Has he $1\frac{1}{2}$ cups left?

Practice for excellence

Do Practice Set III, page 320.

A test in subtracting fractions

— Copy these examples. Subtract. Credit will be given only for answers expressed in simplest form. Try to make a perfect score.

1. $\frac{7}{8} - \frac{5}{8}$

2. $\frac{9}{10} - \frac{3}{10}$

3. $\frac{7}{8} - \frac{1}{4}$

4. $\frac{1}{3} - \frac{1}{6}$

5. $\frac{\frac{3}{4}}{-\frac{3}{8}}$

6. $\frac{2\frac{5}{12}}{-\frac{1}{3}}$

7. $\frac{6\frac{11}{12}}{-2\frac{3}{4}}$

8. $\frac{2}{3} - \frac{1}{2}$

9. $5\frac{3}{4} - 1\frac{1}{3}$

10. $\frac{1}{2} - \frac{2}{7}$

11. $\frac{4}{5} - \frac{1}{2}$

12. $4\frac{3}{4} - \frac{1}{3}$

13. $8\frac{1}{2} - 2\frac{5}{6}$

14. $10\frac{1}{3} - 2\frac{1}{12}$

15. $8 - 6\frac{5}{8}$

16. $\frac{5\frac{11}{12}}{-3\frac{5}{12}}$

17. $\frac{6\frac{2}{5}}{-2\frac{9}{10}}$

18. $\frac{9}{-5\frac{3}{7}}$

19. $\frac{7\frac{1}{2}}{-1\frac{3}{5}}$

20. $\frac{8\frac{1}{4}}{-2\frac{2}{5}}$

Finding fractional parts

1. If 6 boys share equally 84 stamps, each boy will get one sixth of the stamps.

- To find $\frac{1}{6}$ of 84, divide 84 by $\frac{?}{}$.
- How many stamps will each boy get?
- Does $\frac{1}{6}$ of 84 = $6\overline{)84}$ = 14?

2. How do you find $\frac{1}{7}$ of a number? $\frac{1}{8}$? $\frac{1}{9}$?

— Tell each answer.

	a	*b*	*c*
3.	$\frac{1}{3}$ of 96	$\frac{1}{4}$ of 76	$\frac{1}{8}$ of \$.72
4.	$\frac{1}{6}$ of 90	$\frac{1}{7}$ of 91	$\frac{1}{9}$ of \$.99
5.	$\frac{1}{5}$ of 75	$\frac{1}{2}$ of 58	$\frac{1}{4}$ of \$6.40
6.	$\frac{1}{5}$ of 310	$\frac{1}{8}$ of 800	$\frac{1}{3}$ of \$4.20

7. To find $\frac{1}{8}$ of \$872, Don thought:

$\frac{1}{8}$ of \$800 = \$100
$\frac{1}{8}$ of \$72 = 9
so $\frac{1}{8}$ of \$872 = \$$\frac{?}{}$

— Use Don's method to find:

	a	*b*	*c*
8.	$\frac{1}{2}$ of 618	$\frac{1}{3}$ of 924	$\frac{1}{5}$ of 540
9.	$\frac{1}{8}$ of 816	$\frac{1}{7}$ of 735	$\frac{1}{4}$ of \$812
10.	$\frac{1}{9}$ of 927	$\frac{1}{6}$ of \$630	$\frac{1}{3}$ of \$540
11.	$\frac{1}{3}$ of \$912	$\frac{1}{6}$ of \$636	$\frac{1}{9}$ of \$945

12. Twelve sixth-grade pupils are to print 288 tickets for a magic show. To share the work equally, how many tickets should each pupil print?

To find $\frac{1}{12}$ of 288, divide 288 by $\frac{?}{}$. 288 ÷ 12 = $\frac{?}{}$

13. How would you find $\frac{1}{25}$ of a number? $\frac{1}{20}$ of a number? $\frac{1}{32}$? $\frac{1}{36}$?

— Find each answer.

	a	*b*	*c*
14.	$\frac{1}{20}$ of 480	$\frac{1}{30}$ of 960	$\frac{1}{40}$ of 800
15.	$\frac{1}{32}$ of 208	$\frac{1}{41}$ of 294	$\frac{1}{60}$ of \$1.92
16.	$\frac{1}{24}$ of 288	$\frac{1}{22}$ of 137	$\frac{1}{53}$ of \$2.16
17.	$\frac{1}{42}$ of 177	$\frac{1}{33}$ of 268	$\frac{1}{21}$ of \$1.36

18. To find $\frac{7}{8}$ of 72, think: "$\frac{1}{8}$ of 72 is 9; so $\frac{7}{8}$ of 72 is 7 × 9 or $\frac{?}{}$."

19. $\frac{5}{9}$ of 54 means $\frac{5}{9} \times 54$. To find $\frac{5}{9} \times 54$, think: "$\frac{1}{9} \times 54 = 6$; so $\frac{5}{9} \times 54 = 5 \times 6$, or $\frac{?}{}$."

— Find each answer.

	a	*b*	*c*
20.	$\frac{3}{4}$ of 48	$\frac{2}{3}$ of 63	$\frac{5}{6}$ of 42
21.	$\frac{4}{9}$ of 81	$\frac{3}{7}$ of 56	$\frac{2}{5}$ of 45
22.	$\frac{7}{10}$ of 120	$\frac{4}{9}$ of 180	$\frac{5}{6}$ of 540
23.	$\frac{4}{5}$ of 200	$\frac{2}{9}$ of 108	$\frac{5}{8}$ of 648
24.	$\frac{7}{8}$ of 640	$\frac{5}{6}$ of 450	$\frac{8}{10}$ of 360

Using fractions to compare numbers

A fraction may be used to express a comparison.

1. Study the following meanings of $\frac{2}{3}$. Use the picture below.

- 2 out of the ? dogs are black.
- $\frac{2}{3}$ of the dogs are black.
- The fraction $\frac{2}{3}$ compares the number of black dogs with the number of dogs in all.
- $\frac{2}{3}$ is used to compare a group of 2 with a group of 3.

2. Write a fraction to compare the number of white dogs with the number of dogs in all.

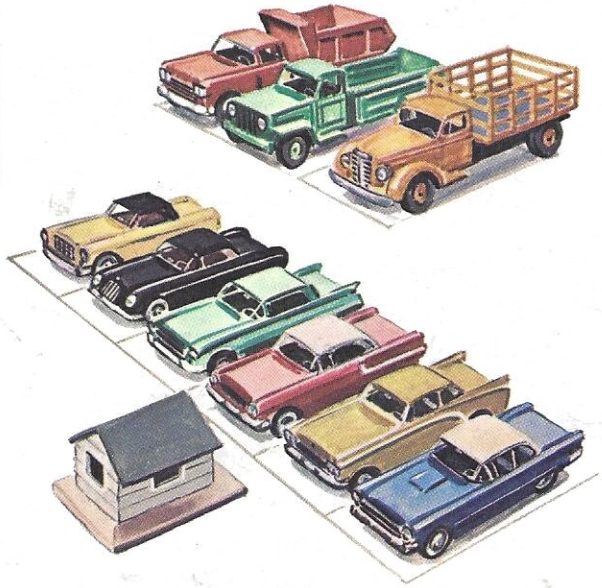
$$\frac{\textit{Number of white dogs} \longrightarrow \ ?}{\textit{Number of dogs in all} \longrightarrow \ ?}$$

- $\frac{1}{3}$ of the dogs are ?.
- $\frac{1}{3}$ compares 1 with ?.
- 1 out of ? dogs is white.

3. What fraction compares the number of white dogs with the number of black dogs?

$$\frac{\textit{Number of white dogs} \longrightarrow \ ?}{\textit{Number of black dogs} \longrightarrow \ ?}$$

- There are $\frac{1}{2}$ as many white dogs as ? dogs.
- There is 1 white dog for every ? black dogs.



4. Study these meanings of $\frac{3}{9}$ or $\frac{1}{3}$.

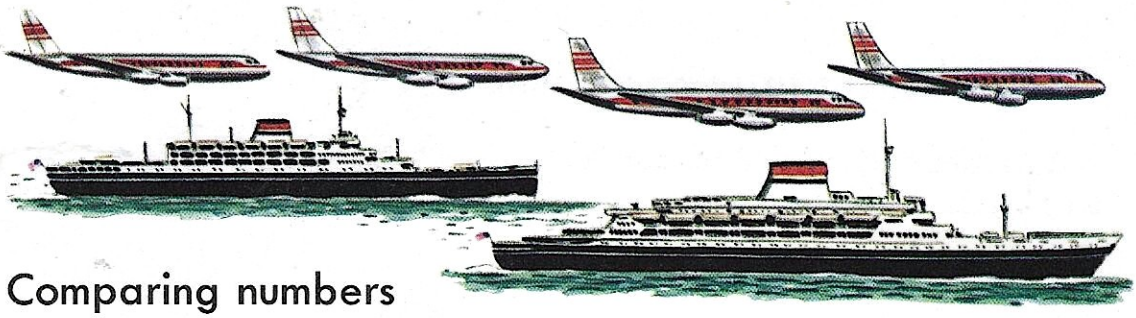
- How many motor vehicles are shown all together?
- How many trucks are shown?
- What part of all the motor vehicles shown are trucks? To find the answer, compare the number of trucks with the number of motor vehicles.

$$\frac{\textit{Number of trucks} \longrightarrow 3}{\textit{Number of motor vehicles} \longrightarrow 9} = \frac{1}{?}$$

- $\frac{3}{9}$ of all the motor vehicles are ?.
- $\frac{3}{9}$ expressed in simplest form is $\frac{1}{3}$.
- 1 out of ? vehicles is a truck.

5. Compare the number of passenger cars with the number of motor vehicles shown.

6. Compare the number of trucks with the number of passenger cars.



Comparing numbers

1. Compare the number of ships with the number of airplanes shown in the picture above.

$$\frac{\textit{Number of ships} \longrightarrow 2}{\textit{Number of airplanes} \longrightarrow 4} = \frac{?}{?}$$

This comparison may be read:

- $\frac{1}{2}$ as many ships as planes
- 1 ship for every 2 planes

2. How would the fraction be changed if you compare the number of planes with the number of ships?

$$\frac{\textit{Number of airplanes} \longrightarrow 4}{\textit{Number of ships} \longrightarrow 2} = \frac{2}{1}$$

This comparison may be read:

- Twice as many planes as ships
- Two planes for every ship

— Use this picture to help you make the comparisons below. Read each comparison in two ways. Express each in simplest form.

3. Compare the number of girls with the number of children.

4. Compare the number of children with the number of girls.

5. Compare the number of boys with the number of children.

6. Compare the number of children with the number of boys.

7. Compare the number of girls with the number of boys.

8. Compare the number of boys with the number of girls.

9. Write a fraction to compare a penny with a nickel; with a dime; with a quarter.

10. Write a fraction in lowest terms to compare a nickel with a dime; with a quarter.

Comparing a part with a whole

At a roadside stand Fred saw a sign: "Strictly fresh eggs."

When he asked for a dozen eggs the farmer showed him this box and said, "I have only *part* of a dozen left. There are 11 eggs in the box."

To find *what part* of a dozen eggs he was buying, Fred compared the number of eggs in the box with the number of eggs in a dozen.

Fred thought, "There are 12 eggs in a dozen. 11 eggs are $\frac{11}{12}$ of a dozen."

1. Write a fraction to compare:

- 1 egg with a dozen eggs
- 5 eggs with a dozen eggs
- 7 eggs with a dozen eggs

2. What part of a dozen eggs is 1 egg? 5 eggs? 7 eggs?

3. How many ounces are there in a pound? What part of a pound is 1 ounce? To answer, compare 1 ounce with 16 ounces. Write:

$$\frac{\text{Compare 1 ounce} \rightarrow 1}{\text{with 16 ounces} \rightarrow 16}$$

4. To write a fraction to compare 4 ounces with the number of ounces in a pound, Sue wrote $\frac{4}{16}$.

To express the fraction in simplest form, she wrote: $\frac{4}{16} = \frac{4 \div 4}{16 \div 4} = \frac{?}{?}$.

Her computation shows that 4 oz. is $\frac{4}{16}$, or $\frac{1}{4}$, of a pound.

— In Exs. 5 to 11, express your answers in simplest form.

5. What part of a pound is 2 oz.? 3 oz.? 6 oz.? 8 oz.? 10 oz.? 12 oz.? 14 oz.?

6. How many inches are there in a foot? Write a fraction to compare 1 inch with the number of inches in a foot.

PROBLEM SOLVING HELP

7. Write a fraction to compare 2 inches with the number of inches in a foot. Your comparison shows that 2 inches is what part of a foot?

8. What part of a foot is 3 in.? 4 in.? 6 in.? 8 in.? 10 in.?

9. What part of a yard is 3 in.? 6 in.? 8 in.? 9 in.? 12 in.? 18? 24? 27? 32?

10. What part of a year is 1 month? 3 months? 6 months? 9 months? 11 months?

11. What part of 30 chicks are 20 chicks? 15? 10? 5?

Tenths, hundredths, thousandths

This is the way Edith uses money to help her understand tenths and hundredths.

1 dollar = 1 whole
1 dime = $\frac{1}{10}$ of a whole
1 cent = $\frac{1}{100}$ of a whole

— Tell how Edith could use coins to illustrate these statements.

	a	*b*
1.	$1 = \frac{10}{10} = \frac{100}{100}$	$2 = \frac{20}{10} = \frac{200}{100}$
2.	$\frac{3}{10} = \frac{30}{100}$	$\frac{7}{10} = \frac{70}{100}$
3.	$\frac{50}{100} = \frac{5}{10} = \frac{1}{2}$	$\frac{20}{100} = \frac{2}{10} = \frac{1}{5}$
4.	$\frac{110}{100} = \frac{11}{10} = 1\frac{1}{10}$	$\frac{13}{10} = \frac{130}{100}$

— Tell the missing number.

5.	$\frac{8}{10} = \frac{?}{100}$	$\frac{?}{10} = \frac{60}{100}$
6.	$\frac{15}{10} = \frac{?}{100}$	$\frac{?}{10} = \frac{200}{100}$
7.	$1\frac{1}{5} = \frac{?}{10}$	$2\frac{1}{2} = \frac{?}{10}$

8. What multiplication will show that $\frac{9}{10}$ and $\frac{90}{100}$ are equivalent?

$$\frac{? \times 9}{? \times 10} = \frac{90}{100}$$

9. What division will show that $\frac{90}{100}$ and $\frac{9}{10}$ are equivalent fractions?

— There is no coin to help Edith understand thousandths.

To find fractions equivalent to thousandths, she multiplies or divides the numerator and the denominator by the same number.

Use Edith's method to find the missing numbers in Exs. 10 to 17.

10. $\frac{3}{10} = \frac{30}{100} = \frac{?}{1000}$

11. $\frac{800}{1000} = \frac{?}{100} = \frac{?}{10}$

12. $\frac{60}{100} = \frac{?}{1000}$ $\qquad \frac{6}{10} = \frac{?}{1000}$

13. $\frac{700}{1000} = \frac{?}{100}$ $\qquad \frac{700}{1000} = \frac{?}{10}$

14. $\frac{1}{2} = \frac{?}{10} = \frac{?}{100} = \frac{?}{1000}$

15. $\frac{1}{5} = \frac{?}{10} = \frac{?}{100} = \frac{?}{1000}$

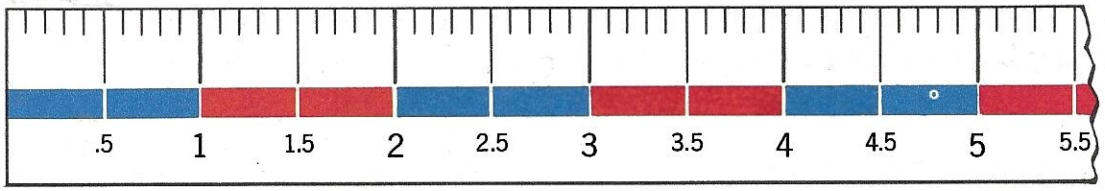
16. $\frac{400}{1000} = \frac{?}{100} = \frac{?}{10} = \frac{?}{5}$

17. $\frac{3}{5} = \frac{?}{10} = \frac{?}{100} = \frac{?}{1000}$

— Which is greater:

	a	*b*
18.	$\frac{800}{1000}$ or $\frac{9}{10}$?	$\frac{1}{2}$ or $\frac{400}{1000}$?
19.	$\frac{220}{1000}$ or $\frac{2}{10}$?	$\frac{280}{1000}$ or $\frac{3}{10}$?
20.	$\frac{15}{10}$ or $1\frac{1}{2}$?	$\frac{3}{2}$ or $\frac{200}{100}$?
21.	$\frac{40}{100}$ or $\frac{4}{5}$?	$1\frac{1}{10}$ or $\frac{110}{100}$?
22.	$\frac{5}{10}$ or $\frac{510}{1000}$?	$\frac{3}{10}$ or $\frac{35}{100}$?

Tenths as decimals



1. On the drawing of the ruler above, each inch is divided into 10 equal parts. How could you use the ruler to draw a line $\frac{1}{10}$ inch long? $\frac{2}{10}$ inch? $\frac{3}{10}$ inch? $\frac{4}{10}$? $\frac{5}{10}$?

The .5 on the ruler means 5 ***tenths*** of an inch.

The dot before the five in .5 is a ***decimal point.***

The number .5 is called a ***decimal fraction.*** The decimal fraction .5 is equivalent to the common fraction $\frac{5}{10}$. $\frac{5}{10} = .5$

The number 1.5 on the ruler is called a ***mixed decimal.*** The 1 means 1 whole inch, and the .5 means $\frac{5}{10}$ of an inch.

1.5 is read "One *and* five tenths." When the decimal point comes between two figures, it is read *and*. $1.5 = 1\frac{5}{10}$

Decimal fractions and mixed decimals are usually referred to as ***decimals.***

2. How is the 2.5 on the ruler read? the 3.5? the 4.5?

3. Read what you see in the box at the right.

4. Write as decimals: $\frac{2}{10}$ $1\frac{8}{10}$ $2\frac{1}{10}$ $3\frac{2}{10}$ $4\frac{3}{10}$

5. Write as common fractions or mixed numbers.

.6 .7 2.6 2.7 2.8 2.9 3.0 3.1

6. Find four pairs of matching numbers.

3.2 2.0 $\frac{2}{10}$ 3 .2 $\frac{20}{10}$ $3\frac{2}{10}$ $\frac{30}{10}$

7. Copy and complete this table.

COMMON FRACTIONS	$2\frac{6}{10}$	?	?	$2\frac{9}{10}$	$3\frac{0}{10}$	?	?	$3\frac{3}{10}$	$3\frac{4}{10}$	?
DECIMALS	2.6	2.7	2.8	?	?	3.1	3.2	?	?	3.5

$\frac{1}{10} = .1$

$\frac{2}{10} = .2$

$\frac{3}{10} = .3$

$\frac{4}{10} = .4$

$\frac{5}{10} = .5$

$\frac{6}{10} = .6$

$\frac{7}{10} = .7$

$\frac{8}{10} = .8$

$\frac{9}{10} = .9$

$\frac{10}{10} = 1.0$

$1\frac{1}{10} = 1.1$

$1\frac{2}{10} = 1.2$

$1\frac{3}{10} = 1.3$

$1\frac{4}{10} = 1.4$

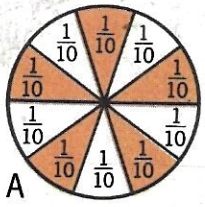
$1\frac{5}{10} = 1.5$

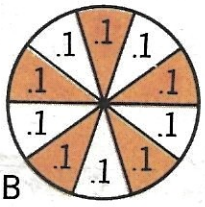
$1\frac{6}{10} = 1.6$

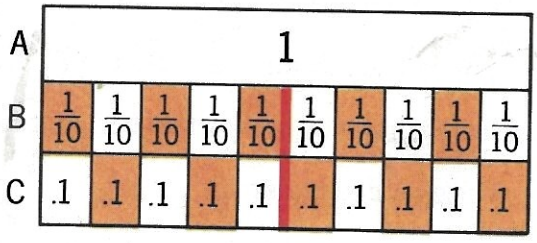
Oral and written practice

— Tell the missing decimals in Exs. 1 to 10. Then copy Exs. 1 to 5 and write the missing decimals.

1.	.4	.5	.6	?	?	?	1.0	?	?	1.3
2.	1.4	1.5	1.6	?	?	?	?	?	2.2	2.3
3.	.2	.4	.6	?	?	?	1.4	?	?	2.0
4.	.5	1.0	1.5	?	?	?	3.5	?	?	5.0
5.	2.4	2.6	2.8	?	?	?	3.6	?	?	4.2
6.	9.2	9.6	10.0	?	?	?	11.6	?	?	12.8
7.	1.0	.9	.8	?	?	?	.4	?	?	.1
8.	1.7	1.6	1.5	?	?	?	?	?	?	.8
9.	2.8	2.6	2.4	?	?	?	1.6	?	?	1.0
10.	10.5	9.5	8.5	?	?	?	?	?	?	1.5







11. Each circle above is divided into ? equal parts.

12. In Circle A show that $\frac{5}{10} = \frac{1}{2}$.

13. In Circle B show that $.5 = \frac{1}{2}$.

14. Does .9 of Circle B equal nearly all of the circle?

15. Is .4 of Circle B more or less than half the circle?

16. If Bar A were divided into 10 equal parts, would it look like Bar B? like Bar C?

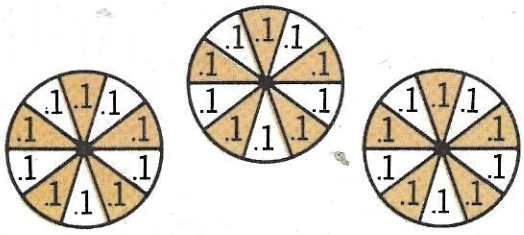
17. How is 1 tenth of the bar marked in Bar B? in Bar C?

18. $\frac{4}{10}$ of Bar B = ? of Bar C.

19. Is .6 of Bar C a little more or a little less than half the bar?

Using tenths

— Use the circles below to help you answer Exs. 1 to 4.



1. Which is more, $2\frac{1}{2}$ or 2.6?

2. Are 2.9 circles about 2 circles or about 3 circles?

3. Are 2 whole circles + $\frac{10}{10}$ circle equivalent to 3 whole circles?

4. Does 10 tenths = 1 whole?
   Does 20 tenths = 2 wholes?
   Does 30 tenths = 3 wholes?

5. Write each as a common fraction and as a decimal.

10 tenths 20 tenths 30 tenths

— Arrange from least to greatest.

	a	*b*	*c*	*d*
6.	$3\frac{1}{2}$	3.4	$\frac{36}{10}$	$3\frac{3}{10}$
7.	2	$1\frac{8}{10}$	$\frac{21}{10}$	1.9

8. Begin with 9.8 and count to 11.2 by tenths. Write the numbers as decimals.

9. In 4.4 is the red 4 worth 10 times as much as the black 4?

Is the black 4 worth $\frac{1}{10}$ as much as the red 4? Check your answer.

10. In the cloudburst did about 2 inches, or about $2\frac{1}{2}$ inches, or about 3 inches of rain fall?

11. How much more rain is 2.9 inches than $2\frac{1}{2}$ inches?

12. If a car travels 19.6 miles, does it travel about 19 miles, or about $19\frac{1}{2}$ miles, or about 20 miles?

13. Which is closer to 3 miles:
- 2.8 miles or 3.3 miles?
- 3.5 miles or 3.1 miles?
- 2.9 miles or 3.2 miles?

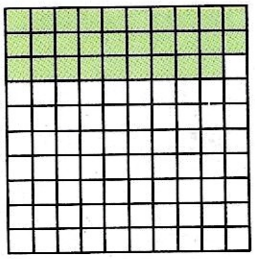
14. A distance of 3.2 miles is how much less than 4.1 miles?

15. It is 3.5 miles from Al's house to Henry's. A round trip is $\frac{?}{}$ miles.

— Express the common fractions as decimals, and then arrange the numbers from least to greatest.

	a	*b*	*c*	*d*
16.	$3\frac{1}{2}$	3.4	$\frac{36}{10}$	$3\frac{3}{10}$
17.	2	$1\frac{8}{10}$	$\frac{21}{10}$	1.9

Hundredths as decimals



1. In the big square, count the number of rows of small squares. Count the squares in a row.
   - There are ? rows of small squares.
   - There are ? small squares in each row.
   - There are ? small squares in all.

2. How many of the small squares are colored?

3. Write a common fraction to compare the number of colored squares with the total number of small squares.

   Are $\frac{29}{100}$ of the small squares colored?

The common fraction $\frac{29}{100}$ and the decimal .29 mean the same. .29 is read 29 *hundredths*.

A decimal having two digits to the right of ones place (to the right of the decimal point) is read as ***hundredths***.

4. Write a common fraction to compare the number of small squares in one row with the total number of small squares. Write that fraction as a decimal. Does $\frac{10}{100} = .10$?

5. Write a common fraction to compare 1 small square with the total number of small squares. Write that fraction as a decimal. Does $\frac{1}{100} = .01$?

6. 2.07 is read "2 *and* 7 hundredths."
   2.17 is read "2 *and* 17 hundredths."
   How do you read 3.08? 4.16? 5.94? 2.01? 3.10?

7. Read what you see in the box at the right.

$\frac{1}{100} = .01$

$\frac{2}{100} = .02$

$\frac{3}{100} = .03$

$\frac{8}{100} = .08$

$\frac{9}{100} = .09$

$\frac{10}{100} = .10$

$\frac{11}{100} = .11$

$\frac{12}{100} = .12$

$\frac{98}{100} = .98$

$1\frac{1}{100} = 1.01$

$1\frac{10}{100} = 1.10$

$1\frac{99}{100} = 1.99$

$2\frac{1}{100} = 2.01$

$9\frac{68}{100} = 9.68$

$12\frac{54}{100} = 12.54$

— Write as common fractions or mixed numbers.

8. .17 .05 .13 .75 .07 .90

9. 2.07 3.10 8.45 12.15 20.40 19.76

— Write as decimals.

10. $\frac{6}{10}$ $\frac{60}{100}$ $\frac{1}{100}$ $\frac{1}{10}$ $\frac{3}{100}$ $2\frac{4}{10}$ $3\frac{4}{100}$

11. $\frac{30}{10}$ $\frac{30}{100}$ $\frac{40}{10}$ $\frac{40}{100}$ $5\frac{6}{10}$ $5\frac{65}{100}$ $7\frac{32}{100}$

Oral and written practice

— Tell the missing numbers.

1.	.28	.29	.30	?	?	?	?	.35
2.	.60	.58	.56	?	?	?	?	.46
3.	1.00	1.05	1.10	?	?	?	?	1.35
4.	6.25	6.50	6.75	?	?	?	?	8.00
5.	1.50	2.00	2.50	?	?	?	?	5.00
6.	2.40	2.60	2.80	?	?	?	?	3.80

— Copy and complete these tables.

7.

COMMON FRACTION	$\frac{5}{100}$	$\frac{10}{100}$	?	?	$\frac{25}{100}$	?	$\frac{35}{100}$	$\frac{40}{100}$	?	$\frac{50}{100}$
DECIMAL	?	?	.15	.20	?	.30	?	?	.45	?

8.

COMMON FRACTION	?	?	$\frac{6}{100}$	?	$\frac{10}{100}$	$\frac{12}{100}$	$\frac{14}{100}$	?	$\frac{18}{100}$	$\frac{20}{100}$
DECIMAL	.02	.04	?	.08	?	?	?	.16	?	?

9. Begin with 4.96 and count by hundredths to 5.05. Then write the numbers.

10. Begin with 12.03 and count backward by hundredths to 11.94.

11. How many sheets of plastic, each .01 inch thick, would you have to put together to make a piece 1 inch thick?

12. Does $.50 = \frac{50}{100} = \frac{1}{2}$?

13. Is 3.92 feet about 3 feet, about $3\frac{1}{2}$ feet, or about 4 feet?

14. Does $\frac{10}{100} = \frac{1}{10}$? Does $.10 = .1$?

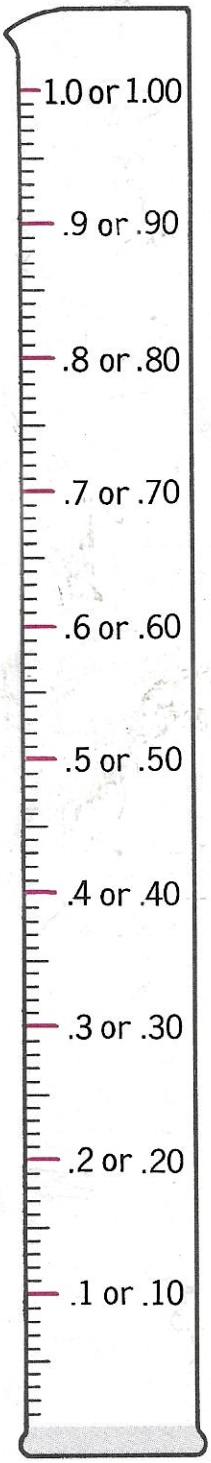
15. In 6.66 the red 6 is worth how many times as much as the 6 to the right of it? The red 6 is worth $\frac{1}{10}$ as much as the 6 to the ? of it.

16. Which is more: .1 of a mile or .01 of a mile?

17. Arrange in order, beginning with the least.

$\frac{1}{2}$ $\frac{3}{10}$ .45 .4 4.5

Tenths and hundredths



1. Shown here is an enlarged drawing of a 1-ounce glass tube, used for measuring liquids. The red marks divide the tube into $\frac{?}{}$ equal parts.

2. At which red mark is the top of the liquid when the tube is $\frac{1}{10}$ full? $\frac{3}{10}$ full? $\frac{5}{10}$ full? $\frac{9}{10}$ full? $\frac{10}{10}$ full? half full?

3. Into how many equal parts is .1 of the tube divided? .2 of the tube? .3 of the tube? .6? .9? the whole tube?

4. The whole tube is divided into 100 equal parts. If the top of the liquid comes up to the first little black line, is the tube .1 full or is it .01 full?

5. Where is the top of the liquid when the tube is .05 full? .09 full? .10 full?

6. Where is the top of the liquid when the tube is .19 full? .20 full? .31 full? .50 full? .75 full? .99 full?

7. When the top of the liquid is at each red mark, the tube is how many tenths full? how many hundredths full? (Begin at the bottom of the tube.)

8. Which is greater: .2 or .19? .9 or .89? 1.0 or .01?
.48 or .5? .78 or .8? .4 or .04? .01 or .10?

9. Where will the top of the liquid be when the tube is .3 full + .03 full? .5 full + .07 full? .3 full + .08 full?

10. Start at .2 on the tube and count upward to .3 by hundredths.

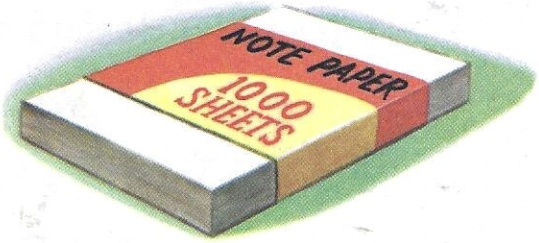
11. Start at .8 on the tube and count downward to .68 by hundredths.

12. What number is .02 larger than .3? .03 less than .6?

13. If the tube is .1 full of liquid and Ted wants $\frac{1}{2}$ of that liquid, how full will the tube be after Ted pours out what he wants?

14. Write as a decimal: $2\frac{1}{2}$ tenths; $3\frac{1}{2}$ tenths; $\frac{1}{2}$ of .1.

Thousandths as decimals



1. One thousand sheets of very thin paper make a pack an inch thick. When you compare 1 sheet with 1000 sheets, would you say that each sheet is $\frac{1}{1000}$ of an inch thick?

The common fraction $\frac{1}{1000}$ and the decimal .001 mean the same thing. .001 is read *one thousandth.*

A decimal having three digits to the right of ones place (to the right of the decimal point) is read as ***thousandths.***

- .007 is read "7 thousandths."
- .024 is read "24 thousandths."
- .156 is read "156 thousandths."
- 5.284 is read "5 *and* 284 thousandths."

2. Study the table at the right. Then write the following as decimals.

$\frac{13}{1000}$ $\frac{25}{1000}$ $\frac{250}{1000}$ $\frac{705}{1000}$ $2\frac{7}{1000}$ $\frac{235}{1000}$

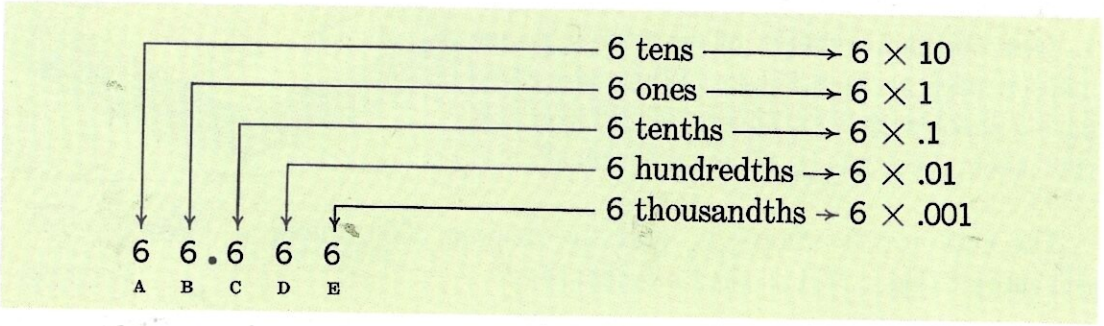
$\frac{1}{1000}$	= .001
$\frac{2}{1000}$	= .002
$\frac{3}{1000}$	= .003
$\frac{5}{1000}$	= .005
$\frac{6}{1000}$	= .006
$\frac{9}{1000}$	= .009
$\frac{10}{1000}$	= .010
$\frac{12}{1000}$	= .012
$\frac{100}{1000}$	= .100
$\frac{999}{1000}$	= .999
$1\frac{245}{1000}$	= 1.245

3. The following table will help you to count by thousandths. Read it. Tell the missing numbers.

What numbers would be in Row 12? 13? 14?

Row 1	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
Row 2	.011	.012	.013	.014	.015	.016	.017	.018	.019	.020
Row 3	.021	.022	.023	.024	.025	.026	.027	.028	.029	.030
Row 4	.031	?	?	?	.035	?	?	?	?	.040
Row 5	.041	?	?	.044	.045	.046	?	?	?	.050
Row 6	?	?	.053	?	?	?	.057	?	?	?
Row 7	?	.062	?	?	?	?	?	.068	?	?
Row 8	.071	?	?	?	?	?	?	?	.079	?
Row 9	.081	?	?	?	?	?	?	?	?	.090
Row 10	.091	?	?	?	.095	?	?	?	.099	.100
Row 11	.101	.102	.103	?	?	?	?	?	?	.110

Understanding decimals



1. The 6 above A stands for what number? What number is represented by each of the other digits, from left to right?

2. The value of any 6 in 66.666 is:

- 10 times the value of the 6 to the ? of it.
- $\frac{1}{10}$ the value of the 6 to the ? of it.

3. In the number .234 the 2 is in tenths place, the 3 is in ? place, and the 4 is in ? place.

4. Bill said that .234 means

$$\frac{2}{10} + \frac{3}{100} + \frac{4}{1000}.$$

Tom said that .234 means

$$\frac{200}{1000} + \frac{30}{1000} + \frac{4}{1000}.$$

How would you show that Bill's $\frac{3}{100}$ equals Tom's $\frac{30}{1000}$?

5. Write these decimals as common fractions or mixed numbers.

.040 .145 2.005 4.075

6. Any 3-place decimal is read as thousandths. Any 2-place decimal is read as ?. Any 1-place decimal is read as ?.

7. In .88 the value of the red 8 is ? times as much as the black 8.

8. Bill said that .9 is the largest one-place decimal, and that .1 is the smallest one-place decimal.

Do you agree?

- What is the largest 2-place decimal? the smallest?
- What is the largest 3-place decimal? the smallest?

9. Mary took 5.465 apart and put it together this way: →

5
.4
.06
+ .005
5.465

George did it this way: →

5.000
.400
.060
+ .005
5.465

Can you show that both were right?

10. Take these decimals apart and put them back together in two ways.

.287 35.829 .640 .056

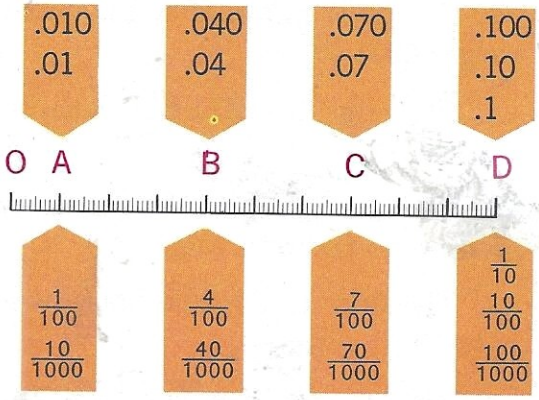
11. What does each digit in each of these numbers stand for?

.12 .123 3.01 1.010 2.222

Thinking about decimals

1. The number line OD below represents $\frac{1}{10}$ of the length of a metal scale.

- OA is $\frac{1}{10}$ of $\frac{1}{10}$, or $\frac{1}{?}$, of the scale.
- Each of the smallest parts is $\frac{1}{10}$ of $\frac{1}{10}$ of $\frac{1}{10}$, or $\frac{1}{?}$, of the scale.
- OB is $\frac{4}{100}$, or $\frac{40}{?}$, of the scale.



2. Tell the equivalent number expressions shown at point A; B; C; D.

3. What must you do to express .1 as .10? .10 as .100?

Does annexing a zero change the value of a decimal?

4. What must you do to express .2 as .200? Make up a rule about annexing zeros in a decimal.

5. What must you do to express .700 as .70? .900 as .9?

6. Make up a rule about dropping zeros in a decimal ending in zeros.

7. Write two other decimals equivalent to each of the following.

.3 .50 .800 .20

— Arrange in order beginning with the least.

	a	*b*	*c*
8.	4.008	4.08	4.800
9.	6	5.8	5
10.	3.50	3.49	3.51
11.	60.25	6025	602.5
12.	32.4	3.24	.324
13.	10.1	1.01	.101

14. Which of these numbers are equivalent to $2\frac{1}{2}$?

2.5 $2\frac{5}{10}$ 2.50 $2\frac{50}{100}$ 2.05 2.500

— What whole number is nearest to each of these?

	a	*b*	*c*	*d*
15.	.9	.99	.999	.501
16.	3.8	3.80	3.800	$\frac{10}{5}$
17.	$2\frac{1}{5}$	2.2	2.20	2.05

— In each pair write the number with the greater value.

18. 6.8 in. or .68 in.

19. 75 lb. or 7.5 lb.

20. .025 mi. or .25 mi.

21. 10.4 in. or 1.048 in.

22. 1.4 hr. or $1\frac{1}{2}$ hr.

That important point!

PROBLEM SOLVING HELP

— The decimal points in some of these numbers have been omitted intentionally. Tell where the decimal points should be.

1. Mr. Lake's car can go 175 mi. on 1 gal. of gasoline.

2. The Wests drive the 1449 mi. to the farm in 3 hr.

3. The thermometer read 56° at 5 A.M. and 828° at 3 P.M.

4. A pint of water weighs 104 lb.

5. Jack's new winter suit cost $2495.

6. A workman repaired the step in 2 hr. and was paid $350.

7. This arrow is 25 in. long.

8. Mr. Law worked 482 hr. in the factory last week.

9. The express train traveled 125 mi. a minute.

10. George is in the fifth grade and weighs 6825 lb.

11. Carl ran the 220-yd. dash in 275 sec.

12. The trailer has 4 bunks, each 25 ft. wide and 6 ft. long.

13. The floor of the tree house was only 32 ft. wide.

14. Tom's toe is 75 in. long.

— The decimal points in some of the numbers in these sentences have been placed *incorrectly*. Where do you think the decimal points should be?

15. The Mercury, a fast express, makes the run at the rate of 7.28 mi. an hour.

16. Three Scouts rode the 36 mi. to camp on bicycles in 42.5 hr.

17. The standing broad jump was won by Jack Shaw, whose jump measured .52 ft.

18. In a fishing contest Tom caught a trout that weighed 4.2 lb. Bob caught one that weighed 40 lb.

19. The paper said that in one hour during a heavy rainstorm 32.0 in. of rain fell.

20. The water at the shallow end of the bathing pool is 25.0 ft. deep. The children who cannot swim use this end of the pool.

21. The skirt of Alice's new suit is 1.85 in. long.

22. In one year Bobby has grown 275 in. taller.

Oral practice

1. Is 4 *and* 5 hundredths written 4.50, or 4.5, or 4.05?

2. Is 8 *and* 45 hundredths written 8.45, or 8.045, or 84.5?

3. Is 1 hundred *and* 12 hundredths written 100.012, or 100.12, or .112?

4. Is $8\frac{55}{100}$ written 8.55, or 8.055, or 85.5?

5. Is $\frac{54}{100}$ written 54, or 5.4, or .54?

6. Is $6\frac{5}{10}$ written 65, or 6.5, or 6.05?

7. Is $\frac{1}{100}$ written .100, or 1.00, or .01?

8. Is $\frac{2}{100}$ written .20, or .02, or .200?

9. Is .003 read 3 tenths, or 3 hundredths, or 3 thousandths?

10. Does $6.600 = 6\frac{6}{100}$, $6\frac{6}{10}$, or $6\frac{6}{1000}$?

11. Which of the following does .49 mean?

$\frac{49}{10}$ $\quad .40 + .09 \quad$ $\frac{40}{100} + \frac{9}{100}$

$\frac{49}{100}$ $\quad .4 + .09 \quad$ $.9 + .04$

12. Which of these expressions is equivalent to .512?

- $.500 + .010 + .2$
- $.5 + .01 + .002$
- $\frac{500}{1000} + \frac{1}{100} + \frac{2}{10}$

13. Which is greater:

1.0 or 0.1? $\quad$ 0.5 or .05?

14. By what do you divide both the numerator and denominator to express $\frac{60}{100}$ as $\frac{6}{10}$?

15. By what do you multiply both the numerator and denominator to express $\frac{30}{100}$ as $\frac{300}{1000}$?

Written practice

— Write in decimal form.

	a	*b*	*c*
1.	$8\frac{5}{10}$	$14\frac{2}{10}$	$80\frac{8}{10}$
2.	$\frac{76}{100}$	$25\frac{5}{100}$	$\frac{27}{1000}$
3.	$3\frac{26}{100}$	$\frac{3}{1000}$	$90\frac{8}{100}$
4.	$\frac{1}{100}$	$10\frac{19}{100}$	$60\frac{6}{100}$
5.	$70\frac{7}{10}$	$8\frac{5}{100}$	$21\frac{4}{10}$
6.	$\frac{5}{1000}$	$2\frac{24}{1000}$	$9\frac{9}{100}$

7. Nineteen hundredths

8. Twenty-nine thousandths

9. Thirty-seven hundredths

Think twice!

— How do you write the number:

10. .05 more than .4? .05 less than .7?

11. .2 less than .72? .5 more than .65?

12. .01 more than .496?
.01 less than .180?

13. .01 less than 1.0? .1 more than .45?

SELF-HELP TEST 1

The number at the right of an example tells you the page on which you can find help. If you make a mistake in Ex. 1, where can you find help?

1. Write, using digits: 24 million, 206 thousand. [6-7]

2. 70,000 is how many times as large as 700? [8]

3. Round 22,986,428 to the nearest million; to the nearest thousand. [11]

4. Express CDLXXI in Arabic numerals. [13]

5. What number does N stand for in $N + 47 = 105$? [19]

6. Is $800 - 348$ about 550, or 450, or 350? [21]

7. 12 and 8 are factors of ___?___. [24]

8. $20 \times 32 =$ ___?___ [26]

9. Find the average of 17, 20, 16, 15, and 12. [35]

10. In $N \times 9 = 216$, find the missing multiplier. [37]

11. Do you estimate the quotient of $175 \div 34$ to be about 3, or 5, or 50? [39]

12. Find the quotient of:

$5149 \div 72$. [41]

13. Express in simplest form.

$\frac{12}{8}$ $7\frac{12}{16}$ $5\frac{9}{3}$ $4\frac{6}{6}$ [49]

14. Find the missing numerators.

$\frac{3}{8} = \frac{?}{16}$ $\frac{4}{5} = \frac{?}{15}$ $\frac{3}{2} = \frac{?}{12}$ [49]

15. In adding fourths and tenths, the smallest common denominator is ___?___. [52]

SELF-HELP TEST 2

Compute.

1. $\frac{5}{16} + \frac{5}{16}$ [50] **2.** $\frac{11}{12} - \frac{7}{12}$ [50]

3. $\frac{5}{12} + \frac{3}{4}$ [51] **4.** $\frac{7}{8} - \frac{1}{2}$ [51]

5. $1\frac{4}{5} + \frac{1}{2} + 3\frac{1}{5}$ [53]

6. $5 - \frac{3}{4}$ [56] **7.** $6 - 2\frac{3}{4}$ [56]

8. $3\frac{1}{2} - \frac{4}{5}$ [56] **9.** $\frac{1}{32}$ of 256 [58]

10. Write a fraction to compare 5 eggs with a dozen eggs. [61]

11. Write as decimals and arrange in order from least to greatest.

$\frac{47}{10}$ $4\frac{1}{2}$ $4\frac{2}{5}$ $4\frac{3}{10}$ [63]

12. Write as decimals.

$\frac{18}{100}$ $\frac{8}{100}$ $5\frac{5}{100}$ $6\frac{47}{100}$ [66]

13. Which is more: .2 or .29? .68 or .8? .1 or .09? [68]

14. Write as decimals.

$\frac{175}{1000}$ $\frac{25}{1000}$ $3\frac{9}{1000}$ [69]

IT'S CHECK-UP TIME

This test will help you measure what you have learned in Chapter 3. Work carefully. Check your answers.

1. Express $\frac{12}{8}$ in simplest form.

2. Copy and complete. $\frac{3}{4} = \frac{?}{16}$

— Compute.

3. $\frac{1}{5} + \frac{1}{10}$ **4.** $\frac{2}{3} + \frac{1}{6}$ **5.** $\frac{3}{4} + \frac{2}{3}$

6. $1\frac{3}{4} + 2\frac{5}{6} + 3$ **7.** $\frac{2}{5} + 1\frac{1}{2} + \frac{3}{5}$

8. $\frac{3}{4} - \frac{1}{2}$ **9.** $5 - \frac{2}{3}$ **10.** $5\frac{1}{4} - 2\frac{1}{3}$

11. Which is greater: $\frac{1}{21}$ of \$252 or $\frac{1}{18}$ of \$252? how much greater?

$\frac{4}{3}$	$\frac{3}{4}$	$\frac{8}{6}$	$\frac{6}{4}$

12. In the box above find:

- a fraction in simplest form
- two equivalent fractions
- a proper fraction
- two like fractions
- a fraction with a numerator of 4

13. Write a fraction in lowest terms to compare 4 oz. with 1 lb.

14. What part of a yard is 12 in.?

— Arrange in order, beginning with the least.

15. .022 .02 2.02 2.2

16. $\frac{3}{8}$ $\frac{1}{4}$ $\frac{9}{16}$ $\frac{5}{4}$

17. Is 4.93 ft. about $4\frac{1}{2}$ ft. or 5 ft.?

18. How do you write as a decimal a number .03 greater than .2?

19. $97\frac{3}{4}$ lb. is $\underline{?}$ lb. less than 100 lb.

20. $104\frac{3}{4}$ lb. and $96\frac{7}{8}$ lb. equal $\underline{?}$ lb.

If you have time, try these –

21. Without doing the divisions, tell which of these would have the largest quotient.

$\frac{1}{21}$ of 126 $\frac{1}{18}$ of 126 $\frac{1}{18}$ of 216

22. Which of the following is a common denominator of $\frac{2}{3}$ and $\frac{3}{8}$?

12 16 30 48 60

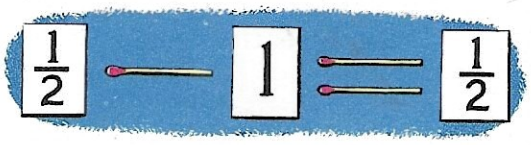
JUST FOR FUN

1. Here the figure 6 is written six times in such a way that the result equals 100.

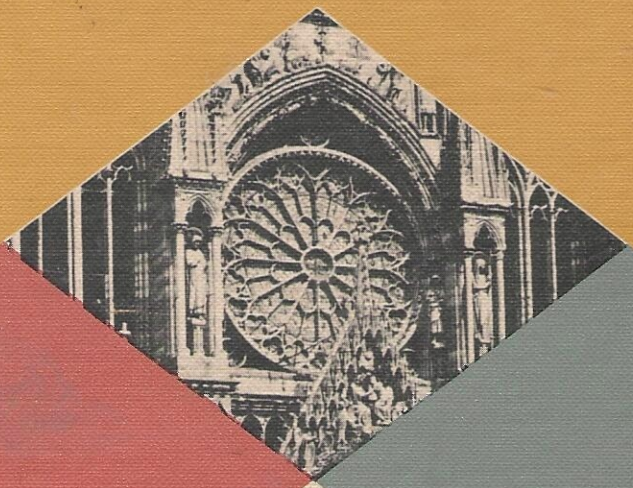
$$\frac{666 - 66}{6} = 100$$

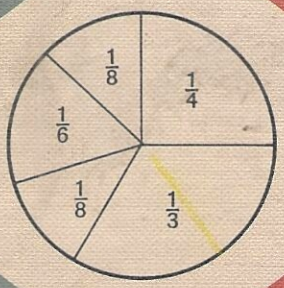
See if you can work out a similar way to use the figure 8 eight times, so that the result equals 1000.

2. Jim arranged cards and matches to make this untrue statement:



By moving one match, can you make a true statement? Do not move any of the cards.





JOHN R. CLARK
HAROLD E. MOSER
CAROLINE H. CLARK
CHARLOTTE W. JUNGE